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WATER SUPPLY,

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EDITORIAL NOTES.

The Chemical Manufacturers' Crusade.

NEITHER party in the fight over the residual products question is pleased with the limiting clauses [see "Parliamentary Intelligence"] that have been framed and put into the South Suburban, Annfield Plain, and Fleetwood Gas Bills. The gas industry is tired of restriction, and does not like the idea of having one hand tied behind in meeting competitors who have perfect liberty; nor does it look agreeably upon any restriction that may limit its procedure or economic development in the future. There we have the reasons why the gas companies concerned do not regard with any favour the clauses that have been inserted in their Bills by Lord Ritchie's and Sir Harry Samuel's Committees. The Alkali Manufacturers' Association do not fully approve of the clauses (they are similar in the three Bills, with slight verbal modifications in the case of the South Suburban) because they do not bind-up the gas undertakings like a lot of Egyptian mummies in the matter of the working-up and dealing in gas residuals, and the derivatives thereof. In our last two issues, we indicated by reference to the evidence how far-reaching are the aims of this combination of chemical manufacturers; and we see the signs of their dissatisfaction with what they have so far procured as embodied in the clauses to which we are now referring. They have, however, got in the thin end of the wedge; and they are going—if possible—to drive it farther home. The spirit of antagonism to the gas industry that has revealed itself in this matter of limiting gas undertakings in order to benefit uncontrolled chemical manufacturers will not be satisfied by matters as they stand to-day.

We see a sign of this in the remarks of Mr. L. Macassey, one of the Counsel for the Association, in the discussion over the Annfield Plain and Fleetwood form of the clause. Pushed into a corner, he reluctantly consented to accept the clause in the existing shape as an agreed one; but mark the conditions—"for this Bill only; he did not want this to bind "the Alkali Manufacturers in regard to any other Bill." This is a fairly clear indication of the intention of the Association to pursue the matter in the hope of a conquest that will comprehend their whole present programme of restriction. Mr. Macassey went further, and wanted the Companies to undertake that they would not set forces to work outside the Committee rooms that might have the effect of the clause being opposed elsewhere. There are suitable and convenient terms that we can individually apply to such a request as this. It is of a piece with the rest of this restricting campaign. Why gas undertakings should be prevented from making use of any available machinery for procuring the rectification of an injustice, we fail to see. Why (if thought fit by them) they should be debarred from the only Court of Appeal that is open to them, is not at all clear. Constituent parts of the gas industry other than the Annfield Plain or the Fleetwood Companies may consider that the clauses introduce a new principle, and a reactionary principle, that in the interests of the public and the industry should be nipped in the bud. Whatever promise may have been extracted from the Annfield Plain and Fleetwood Companies before the House of Commons Committee, does not in any way bind others to remain quiescent if they think it advisable to move.

However, the Alkali Manufacturers' Association have not so far secured all they set out to obtain. Look at the South Suburban clause for example. It does not sever the Company from anything they are doing at the present time. It does not curtail them in disposing of their residuals or other products in the best market, though: is market be a gas undertaking; it does not limit the market from which they may purchase anything that is required in working up their residuals; and it seems to us the Company may develop the working-up of their own residuals (if thought fit) to the length of producing all the chemicals of which the residuals are the base. The harm that the clause does is that, if in future it is found desirable to purchase the residual products of other gas undertakings in order to enable the Company to extend their operations, and by so doing make their own residual products more profitable, they would, as the clause stands, be precluded from doing this. The further harm that it does is that it may hereafter prevent small neighbouring companies from selling to their large neighbours, as is done in many cases to-day, at better profit than may be possible by sending to chemical manufacturers who, without competition in the district, would be in a position to drive a hard bargain with the small concerns, already possibly burdened by the cost of long-distance transport. The only thing will be, if these hardships should arise in any case where this or other similar clause is imposed, the companies concerned will have to come to Parliament, and ask for relief from the unfair position in which they have been placed by this attack of free competitors, who, in all their commercial doings, are a law unto themselves. The more the situation is examined, the more is the injustice seen, and the more convinced are we that the Alkali Manufacturers' Association are intending further mischief in this direction if they can in any way manage it. They may, however, find in the future that they have an incensed gas industry with which to deal; and their latter state may not be the better for their present action.

The Coal Strike—and After.

A MORE hopeful condition of affairs now obtains in connection with the coal strike; but our readers who have been watching with deep anxiety, day by day, and almost hour by hour, the course of events, need no narrative here as to matters of which they already know only too well. The Minimum Wage Act for the miners is on the Statute Book. The men have gained the principle for which they left work; but so rapid is the generation of the desires and ideas of the leaders of the coal miners that, once the principle seemed safe, then more was wanted for which the men did not strike, or rather which was not a point that had been the subject of ballot. Another ballot is now being taken. But, whether or not the result is favourable to the resumption of work upon the terms embodied in the new Act, the measure is the law of the land, and a majority of the men must now be well assured that they will only be contributing further to the weakening of their own position, and to the debilitating of the country generally, by prolonging the days of idleness. While there are a few leaders of the men who are stupidly, and we may say almost criminally, in view of the condition of parts of the country, advising the miners to stand out until they have secured the full pound of flesh that certain of the leaders demanded, others are now wisely counselling them to place citizenship above trade unionism, and to go back, now that the principle of the minimum wage has been gained, in the same solid body as was presented by a large majority when they came out. These are the leaders to whom the bulk of the miners appear disposed to listen. A small return to the pits has already been made; and there will be grave disappointment in the country if this week does not see a good start made in supplementing scanty coal stocks, and replenishing empty stores.

There will, however, be a big scramble for the first-fruits of the return to work; and until regular deliveries are restored, large users of coal will not feel happy or comfortable. Several gas undertakings have got "near to the knuckle" in the matter of their precious reserves; and precautionary measures in some cases have led to certain curtailments of service. There are lessons of this and immediately preceding strikes that will not be readily forgotten. This, and the transport workers' and the railway strikes, combined with the lines of the development of the gas industry, point to the need in future of carrying larger stocks of coal and oil than was the case only a few years ago. Take Birmingham

as an example. An announcement comes from that city as to a curtailment of the gas supply during part of the daylight hours. This announcement is not the result of any want of foresight; it is due to a concatenation of circumstances that the Gas Department of the city nor the whole forces of the City Council could possibly defeat. Ever since the railway strike last August, the department has been trying to recover the expenditure of stock that was then entailed. But the disorganization of goods traffic on the railways that succeeded, followed by the winter demands for coal and gas, with increased stocking everywhere, have prevented this being done. Birmingham has not been alone in this regard. Many other gas-works dependent on railways for supplies have similarly suffered. Then the large day demand for gas in the city for industrial and domestic purposes has been rendered larger still—altogether beyond any guiding precedent for the period of the year—since the coal strike began. Manufacturers, faced by the stoppage of solid fuel, and fearing for their ability to meet the large seasonal demand for certain goods, had abnormal recourse to their gas-services for heating, and worked at high pressure and full capacity in order not to suffer, though others might in consequence fare badly. The domestic consumer, again, with a gas-cooker at command and a gas-fire or two, it appears, now takes small heed of the condition of his coal-cellar when a strike threatens; and the domestic consumer has been (this is the experience in several districts) relying during this strike with perfect composure upon his alternative fuel agent—the gas undertaking. It has been so in Birmingham. Count will have to be taken of these labour, manufacturing, and domestic tendencies in future when calculating what is a safe coal reserve. A strike of the present character indeed opens the eyes to the influence of contemporary circumstances.

On the Verge of Further Development.

We believe that the gas industry is on the verge of further development of a very material order—both in business and in the appliances by which gas is used. This must be the opinion of all who have visited the Smoke Abatement Exhibition at the Agricultural Hall, and have made a particular study of the exhibits that are to be found there. The belief is hardened by the information as to the growing popular credence in the efficiency and economy of gas for cooking and heating that has been gathered during the proceedings at the conferences of those who have taken up, and persevered in with an ardour deserving the highest encomiums, the campaign for the abatement of the smoke nuisance. It is a difficult task that these public-spirited men have had, and have still before them; but they are being backed up in their work by the advancing improvements in the appliances for the use of gaseous and smokeless fuel, and by a distinct change in scientific, municipal, and public opinion in support of their propaganda and objects. There is a feeling that there is no single road to the end, but that there are several ways that are contributory to accomplishment. Some of the ways suggested are impracticable. But practical ways give the unpractical the go-by; and reasonable means are already well on the highway to the goal, though the distance to be traversed to final suppression is immeasurable. The end may never really be reached; but that a large part of the journey will be accomplished, and that in the lifetime of the present generation, is a prediction that few will deny who are qualified by comprehensive observation to judge.

The voice of these smoke abatement conferences is worth listening to by those with the helms of the gas industry in their hands. Gas and coke and other solid smokeless fuels were spoken of more than anything else, by delegates from all parts of the country, as the means that must be looked to for making progress. Electricity was only incidentally heard of; the feeling being that, for general and long-hour heating purposes, it is too costly, and of insufficient heating value at the price, to warrant its use. General heating by coal is what contributes most to an unhealthy and dirt-laden atmosphere. The domestic hearth is a terrible sinner; but there is satisfaction with the efforts that are being made by gas authorities to reduce the price of gas and to improve their coke, and with the successful endeavours of makers of gas-heating appliances in the matter of enhancing efficiency. Both these are the causes for the boom that there has been in gas-fires and in water-heaters for domestic purposes during the past two or three years. They are inseparable causes if the utmost success is to be achieved; and there is a salutary realization of this throughout the gas industry.

The gas-fires shown in use at the exhibition illustrate the advances in this line to date; and the exhibition even carries us to a new form of gas-radiator that meets the views of those who are enamoured of the appearance of the electric radiator, even though they are disappointed with the heating capacity and the cost of the latter. In the matter of cooking by gas, we are not altogether sorry the electric-oven has had its virtues proclaimed with such loud voice and persistence, while all the demerits have been suppressed. The former fact is having a stimulating influence in the gas industry. In the first place, the claims of the electricians in regard to cooking are being tested with the utmost care; and what they have not told us is being discovered by exact investigation. In the second place, in the matter of construction, there is also inquiry as to whether the main principles to which makers of gas-cookers have tenaciously clung for long (good as they are in result and economy, compared with other means of cooking) are not capable of improvement. All constructive investigation and endeavour have to be encouraged; and among the fruits of this work is found the first departure in removing the gas-jets from the interior of the oven, and the provision of a practically enclosed oven. Energetic investigation is proceeding in this direction. What the final outcome will be we cannot say. In the pursuit of economy, invention is also being directed to the utilization of the flue heat for providing hot water while cooking is proceeding; and, at the exhibition, there is to be seen the utilization of water-coils connected with the house hot-water circulating system from a coke-fed boiler, for heating a hot closet for keeping food warm and warming plates. Again, the top plate of the gas-cooker, though there are economical and convenient means there for boiling and other work, is the seat of much unnecessary waste of gas. Attention we know is being directed to this point. Those makers who are not considering these matters in connection with the future of the gas-cooker had better soon devote attention to them. What is before us in relation to the domestic utilization of gas is, there is confidence in saying, immeasurably greater than what has already been accomplished. In the race for supremacy, the front line has been well kept; the contest will be keener yet, and some may drop behind in future—through what?

While on this subject of the cooker, it would have been a satisfaction to have seen at the exhibition a large and effective display made of properly constructed utensils for use on gas-cookers. Many of the old-fashioned commercial articles that are employed by consumers are as unfit as anything can be for the work required with gas as the fuel. We present the idea free to anyone who cares to take it up, that with approximately three million gas-cookers already in use in this country, and much more yet to be done, there would be a respectable business for a firm of specialists in gas-cooker utensils. A special stand of such things at exhibitions would be very popular with the lady visitors; and their growing use would be to the advantage of gas. Mention has just been made of the approximate number of cookers in use in the United Kingdom. The Secretary of the Smoke Abatement Society (Mr. Lawrence W. Chubb), at the conference, gave the latest statistics as to the number of gas heating, cooking, and hot-water appliances that the Metropolitan Gas Companies have supplied. The total is 1,494,000, which is a growth from the 46,000 of twenty years ago, and from 989,000 five years since. This is highly satisfactory and encouraging. There is another trend in events that was pointed to by more than one speaker at the conference. It is that gas for cooking, being generally supplied at the same price as for lighting, the policy of the free supply of cookers—a policy that is not new in some places—is a largely extending one. Paisley, it was stated, has long followed the practice; Glasgow has (and so has Edinburgh) lately adopted it; Halifax is considering it.

We look further round the exhibition; and the gas appliances for the provision of hot water are seen developed to a degree of which the public have really little conception. In the matter, again, of gas-furnaces, &c., for industrial work, these have been brought to a high state of perfection; and work in this direction is still proceeding. Gas-engines are not largely represented at the show; but Sir William Ramsay, at the inauguration luncheon, told the 170 or so guests there assembled that the gas-engine is capable of usefully developing in the form of work a larger percentage

of the energy of coal than any other primary motor dependent on coal or its products.

Much advice was tendered at the conference to gas undertakings as to the necessity of producing a solid smokeless fuel by arresting carbonization, and so leaving some of the volatile constituents in the material. Such advice is offered with all good intention; but it shows an ignorance of the economic problems and considerations involved. These need not be discussed—at any rate, on the present occasion, as it is a very large subject. To carry out the ideas would mean the penalizing of the gas consumers, just as, as Bailie Smith and others pointed out at the conference, does the appropriation of gas profits in aid of the rates. It is the irony of fate in those cities and towns where there is this transference of gas profits in aid of the rates, that those who, by using gas for cooking and heating, contribute to the maintaining of a purer atmosphere are compelled thereby to pay a greater share towards local expenditure than the ratepayers who use coal for cooking and heating, and so contribute to the pollution of the atmosphere. There were proposals before the conference as to legislative action. But education, wise administration, and invention, will be, as they are, more potent factors towards the end that the exhibition and conference are destined to serve.

The Life of Dessau Settings.

THERE are two instructive companion articles in our columns this week from Germany—one by Dr. R. Nübling, of Stuttgart, and the other by Dr. W. Bueb; and in the order in which the authors are named the articles should be read. Dr. Nübling set himself to work to compare the financial considerations applying to a large modern installation of horizontal retort plant that he has at Stuttgart with those applying to a vertical retort installation on the Dessau system. It was an ambitious, intricate, and delicate piece of work that he took in hand; and he discharged the self-imposed duty with commendable care so far as the available published information regarding vertical retorts aided him. Efforts of our own have proved to us that to compare the two systems in all the financial aspects in order to obtain a reliable result is most difficult, as the conditions are distinctly dissimilar, and therefore, in comparison, puzzling. Make and illuminating and calorific values may be about the same with both systems; but then, in connection with the vertical system, we have the lessened difficulties in regard to naphthalene, sulphur compounds, and stopped pipes. In some instances, there is mitigation of these troubles with heavy charges in horizontal retorts. Further there come in the questions of capital charges, maintenance and renewals, wages, and fuel. Some of the items are readily comparable; but no final financial contrast can be made until everything is taken into account, in view of the differences in individual conditions.

Dr. Nübling's investigation leads him to the conclusion that, in ultimate results, his horizontal settings show an advantage compared with the Dessau system, eighteen retorts in a setting, of £1 2s. (£21 8s., as against £22 10s.) per million cubic feet of gas—including interest, amortization, wear and tear, wages, and fuel. But the main question on which a halt has to be called is as to whether Dr. Nübling has given sufficient credit to the Dessau verticals in the matter of life. Upon this depends the correctness of his amortization and maintenance charges, and therefore the correctness of the final deduction he makes from his financial investigation. Unfortunately, in the matter of the life and maintenance expenses of vertical retorts, Dr. Nübling has perforce had to depend largely on incomplete experience and hypothesis. This leads to Dr. Bueb's article; and among several other striking points, he submits the almost startling opinion that Dessau vertical retort-settings may be allotted a working life of 25 years. If this be so, one can readily see the important effect that this would have upon the charges for maintenance and renewals, and therefore on the structure of Dr. Nübling's financial comparison. Then comes in the question of the cost of wear and tear; and on this point chief reliance is based upon Mr. E. Körting's experience at Mariendorf, where the oldest vertical retort-settings have had 1600 days' run without repair; and Mr. Körting hopes that they will continue 2000 days without needing any. The quarter-of-a-century life estimated by Dr. Bueb is apparently based upon an average working year of 200 days; so that his estimate of 25 years would have to be modified by any change in this condition. With the more modern form of Dessau settings, with eighteen retorts in each, inasmuch as they incorporate structural experience derived from the working of the older settings, Mr. Körting's experience on the matter of wear and tear should be still more gratifying. This point as to probable age is an extremely interesting one; but we wonder whether Dr. Bueb's remarkable estimate will be confirmed by the result. The interest of ultimate proof has manifestly, if he is correct, to be deferred for some years yet. The reasons why the Dessau verticals gave such a good account of themselves in this matter of robustness and life are stated by him in the article. Of course, the question of life is not the only consideration affecting the adoption of verticals. There are several others—labour and local circumstances, for example; but the one raised here as to life is not the least important among matters to be taken into account.

Dr. Bueb also discusses the question as to the size of vertical retort-settings for small gas-works of different and (individually) widely varying seasonal output; and he lays down a rule that he considers may be fairly generally applied, though local circumstances may affect it, as to the smallest make for which Dessau retorts can be economically employed. He puts the lowest point of economical application at somewhat under 35 million cubic feet. This question has among engineers been a matter of some speculation; and despite Dr. Bueb's rule, despite too the returns from experimental settings, there will be sceptics still.

Exposing the Claims of the Electric-Cooker.

THE eagerness of the electric-cooker platform orators and of writers of advertising articles and leaflets to get the public to take kindly to cooking by electricity does not appear to be reciprocated by an equal eagerness to respond on the part of the public. The electricity enthusiasts in this line have made the egregious mistake of being too assertive regarding the miraculous performances of their own goods, and too persistent and extravagant in attempting to besmirch the excellent reputation enjoyed by their rival. The public—or, at any rate, the greater and intelligent part of the public—always look, and very properly, with suspicion on advertisers of innovations who adopt these tactics. The long and large experience of the public enables the gas-cooker to lightly meet the windy and slanderous utterances and writings regarding itself; but the claims respecting the electric-cooker have to be dealt with, so that the public may know how much of what they are told is true and how much is untrue, and how much is left unsaid that it is to their interest to know. Those commercially concerned in electric-cookers, and some of the officials of electricity undertakings, are indefatigably pursuing their campaign under the disadvantage—a disagreeable disadvantage to most men—of the secret knowledge that all is not as represented, and that there is much omission on their part. But that is no reason why, in the commercial world, false statement or imperfect and deficient statement, should be allowed to obtain currency if there are the means available for setting the matter right in the eyes of the public.

There are the means available. It is an easy matter for gas undertakings to become possessed of electric-cookers; and to put them "through their facings," in comparison with gas-ovens. This is being done by various gas undertakings within our knowledge; and this week we have some of the first results—these being from Mr. Joseph Cash, M.Inst.C.E., the Chief Engineer of the Brighton and Hove Gas Company, who has, at our request, courteously placed representative results at the disposal of our readers, and for this there is indebtedness to him. The names associated with the tests are a sufficient assurance in the gas industry that both tests and results can be relied upon, and can be reproduced. The article accompanying the figures should be read carefully, as the whole of the points and considerations advanced in it cannot be dealt with here. The main point of the electrical people as to the shrinkage of meat through evaporation is shown, as far as the gas-oven is concerned, by tests carried out without any special means being taken to protect the joints, to have been (as we knew that it was) a gross exaggeration, when a gas-oven is used as it should be. The effects of the low temperature and longer time baking of meats in electric-ovens is being investigated in other quarters. We come to the point as to cost; and here the savings by gas cooking, with gas at 2s. 10d. per 1000 cubic feet, as against 1d. per unit for electricity, tell a tale with which the electrical people will have

some difficulty in coping. For a short-hour, concentrated load such as a large cooking demand would be, 1d. per unit could not pay electrical undertakings; and they have to get below half that cost to compete with even the present type of cooker, and a price of 2s. 10d. for gas, without counting upon improvements. The accumulations of these differences will mount up in the course of the year; and adding to them the greater cost of repairs and replacements, in comparison with the gas-oven, the sum will be a considerable one.

In connection with this question of cost, the subtle electrical people, in their platform and printed addresses to the public, choose only to speak of baking, as though in baking is condensed the whole work of the preparation of food. It is nothing of the kind. Boiling has a considerable part, and there electrical operation is a waster of time and money of a most disreputable order. But urges the vendor of the electric-cooker: "What you lose on the swings, you gain "on the roundabouts—see what you save in evaporation, "weighed up and charged out at the price of raw solid "meat as purchased at the butcher's." The lay public are already being tickled by the vaporous talk on this point of the oleaginous-tongued electrical salesman, and by the idea of vapour being worth as much per pound as raw meat. It may be to the electric-cooker advocate, but not to others. But this point as to boiling food and water provision is an important one; as is also the greater cost in time and money of preparing food and conducting the work of the kitchen and scullery by electrical means.

The results of investigating work such as we have obtained from Mr. Cash, and have incorporated in an article elsewhere in this issue, will usefully assist in dispelling the mist that the missionaries charged with the work of advertising electric cooking are trying to raise before the eyes of the public in the effort to capture custom.

Luxuriant Prosperity.

Such notable progress as the San Paulo Gas Company, Limited, continue to make year by year cannot be passed without special reference. The city naturally participates in the prosperity of the State, and the Company in the prosperity and consequent development of the city. All the modern aids to the stability and expansion of the gas business are applied in this far-off city by the Directors at home and the local management. The use of gas cooking and heating appliances is making magnificent progress; and, in lighting, by the assistance of high-pressure gas-lamps and modern low-pressure burners, gas is holding its own against the strenuous competition of electricity. Let us just cite in proof a few of the percentages from the remarkable figures quoted by the Chairman (Mr. D. M. Fox) at the meeting of the shareholders last Thursday. The total increase in the gas consumption last year for all purposes was 18 per cent. Separating private from public consumption, there is an advance marked of 25 per cent., compared with 15 per cent. in 1910. The gross receipts for the year increased by 22 per cent.; while the net profits showed an advance of 46 per cent.

Trades Union Membership and Funds.

The Labour Department of the Board of Trade are in the habit of publishing at three-yearly intervals a report on Trade Unions in the United Kingdom; and one of these—the seventeenth of the series—has recently been issued. The period dealt with is from 1908 to 1910 (the latest year for which returns are available); and though, of course, the statistics are a little late in making their appearance, the publication has come at a time when an unusual amount of attention is being paid to the doings of these organizations. Perhaps, when they come to be printed, the returns which cover the present year's operations may prove to be of a more interesting character than those now under notice. The years 1908 and 1909 covered a period of bad employment and falling wages; and these facts, it is pointed out, appear to have had a considerable effect on the membership of trade unions, which declined by 57,000. This falling off, however, was more than counterbalanced by an increase of 73,000 in 1910, which was a year of improving employment. The net increase for the three years was thus 16,000, which left the total membership at 2,436,000, or less than 1 per cent. above that of 1907—a rate of increase which compares with a rise of 27 per cent. in the previous three years. The accounts are summarized of one hundred of the principal trade unions, representing about three-fifths of the total membership, and about four-fifths of the expenditure of all trade unions on unemployed, sick, and accident benefits. In the period covered by the report, the total amount of dispute benefit paid by these unions was £1,120,000, and of unemployed benefits £2,650,000. The expenditure on sick and accident, superannuation, funeral, and other benefits and grants came to £3,180,000. In consequence of this heavy expenditure, and notwithstanding a considerable increase in annual income, the total funds of these unions, which reached their highest point (£5,640,000) in 1907, were reduced to £5,120,000 at the end of 1910. During the nineteen years for which particulars are available (1892-1910), the total expenditure of the hundred principal unions was £35,300,000, of which £5,100,000 was spent on dispute benefit, £8,900,000 on unemployed benefits, and £14,100,000 on other benefits (sickness, superannuation, &c.). The total funds of these unions, which at the end of 1893 were only £1 8s. per member, gradually increased, till at the end of 1906 they were £4 per member. At the close of 1910, they were £3 10s.

Coalite Infatuation.

The shareholders of the British Coalite Company, Limited, have been called together again, and have been told once more, as though the irritation of the old sore is a proper and pleasant thing, that they have been duped in an extraordinary manner, and are the men who were induced by City artifice to dream the most fantastic of dreams and to see wondrous visions. More than half-a-million of capital has irretrievably gone; and the assets of the Company stand at a figure to-day that are small in comparison with the loss, but magnificent, we are inclined to think, as an illustration of the power of imagination. The report on another page of the proceedings at the meeting last Wednesday will supply the actual figures. The present Directors refuse to take any responsibility for the position of affairs. We do not blame them. Sir William Preece has shown a disinclination to continue to participate in responsibility, in view of the condition of his health. He is not to be blamed. The shareholders have seen several fresh faces in the chair in the short career of the Company; and now Mr. James Todd is occupant of the position. Will he be the last of the line of brave successors? The Syndicate, with the awful title of Eticoal (which has been constructed by reversing the tail of coalite, and using it as a prefix to coal), who are going to work the plant at Barking, and *if* any profit is made are generously going to share it with the British Coalite shareholders, have the same old confidence running in the veins of the members as has for years, so profession led to the belief, been coursing through the veins of so many other people who were infatuated by a skilfully presented idea. If they are willing to go on dabbling in this matter, they can do no harm now to anybody but themselves. Year after year fresh children build new castles on the sands of the seashore; the result is ever the same.

The Woodall-Duckham Retorts at Lausanne.

The Woodall-Duckham Company have recently received from the Director of the Industrial Services at Lausanne (M. Maillefer) the following particulars of the results of the trials of the settings of vertical retorts on their system at the gas-works at Malley from the 11th to the 17th ult., using German coals in the following proportions: Marlenbach, 74·37 per cent.; Altenwald, 13·9 per cent.; and Heinitz, 11·73 per cent. The total weight of dry coal carbonized was 824,032 lbs., and the total quantity of gas produced, at 60° Fahr. and at the mean pressure of the works, was 4,595,670 cubic feet; the mean specific gravity of the gas being ·469, and the mean vacuum during the trial zero to 1 mm.

	Results.		Guarantee.
Gas made per 100 kilos. of coal	12,492 cub. ft.	..	12,000 cub. ft.
Calorific power, mean during trial, at 60° Fahr. and 30 in. bar.	595 B.Th.U.	..	570 B.Th.U.
Coke used as fuel, 87,010 lbs.	10·55 per cent.	..	16 to 18 per cent.
Gas made per bed per 24 hours	150,022 cub. ft.	..	123,606 cub. ft.
Gas made per retort	37,505 ,,	..	30,900 ,,

M. Maillefer adds: "The figures in the second column are those guaranteed under your agreement of Oct. 9, 1909. It is evident from the foregoing figures that you have advantageously fulfilled the conditions of your contract; and we have much pleasure in giving you acknowledgment of this fact by the present letter. In consequence, we shall hand over to you the sum held by us as guarantee, and now due to you."

NOTES FROM WESTMINSTER.

We have already come to a pause in Committee work; and there will not be any resumption of activities by the Commons Committees for a fortnight, and by the Lords Committees till a week later. The strain on our Legislators the past few weeks gives them the right to a little holiday. Between those dates and Whitsun, there should be a clearing off in the first House of the contested Gas Bills, as a large number of the measures are now unopposed, including the Joint Standard Burner Bill. The House of Lords Committees who will be sitting after the Easter recess will be having the bulk of the remaining interesting gas measures before them that are opposed. Among others will be the Wandsworth and Putney, York, and Wakefield Gas Bills. The Joint Bill promoted by various Gas Companies, and known as the Benefits Fund Bill (for the employees of those Companies) has been split up, so that each Company has its own Bill. It is hard to see the necessity for this, unless it be (we scarcely like to suggest such a thing of the parliamentary authorities) the impious desire not to let the House fees suffer by combined promotion. If this be so, the National Electric Construction Company's Bill and the Bill promoted by the National Municipal Electrical Association could also be split up—the former into as many towns as the measure refers to, and the latter into as many Bills as there are financial supporters to the measure—and give golden opportunities to the Parliamentary Treasury. However, the Benefits Fund Bills will be coming before a Committee, of which the Chairman will be the Earl of Camperdown. We have a large amount of faith in, and respect for, this old Committee room campaigner; and these Bills, we feel confident, will be safe with Lord Camperdown in the chair. He has a practical way of looking at things; and we cannot imagine him doing aught else than blessing any reasonable scheme for the amelioration of the lot of workers in any industry. We hope his advice to his colleagues, in dealing with the municipal opponents of this measure, will be: "Confound their politics, Frustrate their Knavish tricks." In the Commons, the Birmingham gas scheme and the National Electrical Construction Company's Bill should supply interest soon after the recess.

Chemical Manufacturers' Crusade. Comment is made in our editorial columns upon the clauses passed, at the instance of the Alkali Manufacturers' Association, to prevent the extension of the operations of the South Suburban, Annfield Plain, and Fleetwood Gas Companies in the matter of working-up residual products. The clauses, as passed, are set out in our "Parliamentary Intelligence;" and at that and the editorial comment the matter may be left—excepting that it may be said the Association have not secured all they require, and that it seems plain they are going to try to win more advantage still in connection with subsequent measures. Now that they have started on the warpath, and have scored one partial success, they are not going to give in; but it is a big task they have undertaken. The end is not in the present success, nor, if we mistake not, in the present session; and the gas industry should look at the matter from the broadest point of view, and consider well the issues—including what this movement means in respect of preventing future developments of the residuals branch of the gas industry's business, the limitation involved in the curtailment of the markets for residuals, and, as time goes on, the increased compulsory trading with the members of this combination of chemical manufacturers—if they are further successful in their parliamentary campaign—unless to it all at some period a counter commercial move is made for the advantage of groups of gas undertakings all through the country. The existing chemical manufacturers might then consider they were ill-advised in what would be for them the memorable session of 1912.

Electric Tramways and Gas-Mains. In connection with the fight that there has been over the various Traction Bills referring to Brighton and the neighbourhood, the Brighton and Hove Gas Company have secured by agreement certain facilities and protection, as described in our "Parliamentary Intelligence." With regard to the prohibition as to the laying in, under, or over the towing-path of Shoreham Harbour any electric conduit, wire, rail, or cable for the transmission of electrical energy, it may not be known to all readers that this is the location of the Company's large Portslade works; and, from the very first, the Directors of the Company and their Engineer (Mr. Joseph Cash) have been solicitous for the safety of the trunk mains leading from these works.

Bawtry Gas and Water. The Bawtry and District Gas Bill is now unopposed; and therefore it has been sent to the Unopposed Bills Committee. But the Bawtry and Tickhill Gas and Water Company's Bill has met an altogether different fate. It was vigorously opposed, by both the Notts County Council and the Doncaster Rural District Council. A scheme for a new water supply was contemplated; the wells being situated just over the border in Nottinghamshire. The Company were looked upon as an intruder in Notts, and the intrusion was deeply resented. The Doncaster Rural District Council were also interested as the providers of the wells from which the Bawtry Company at present obtain their supply. There was a good deal of evidence to show that there is general contentment with the present supply; but if the Company had not considered the scheme prospectively essential, it is rather curious they should have been so anxious to get it through Parliament. However, Lord Ritchie's Committee settled the matter by rejecting the project.

Keighley Water. A big discussion has been going on before the section of the Local Legislation Committee presided over by Sir Charles Nicholson. It arises out of the scheme of the Keighley Corporation to construct a couple of reservoirs in substitution of reservoirs previously sanctioned by Parliament. A host of Counsel and witnesses have been engaged; the millowners and manufacturers on the Worth and Aire being somewhat anxious as to their compensation water rights. Several days have already been absorbed over this matter; and now the Committee have adjourned their sittings until April 16.

ELECTRICITY SUPPLY MEMORANDA.

Seeking for Light—Not Much (If Any) Found—The "Foul Thing" and a Limited Experience—Feeding Debenhams, Limited—Singular Electrical Calculations and Statements—The Occasional Bath.

The message went round soon after the first informal discussion of the Institution of Electrical Engineers on how best to develop the use of electricity for purposes other than lighting, that the conference was a private one, and that reports of the proceedings were not to be published. This being so, a report we had in preparation was, out of respect for the ruling of the powers that be, at once suppressed, though really we cannot see that the publication of commonly known facts could have been in the least detrimental to the electricity supply industry. If the message reached the office of "The Times," that paper is above the ruling of the Council of the Electricals; for on Wednesday last more than a column report appeared in it. Therefore, precisely as though unrepresented at the meeting, with this report before us, reference may be made to a few points. The object of the informal discussions is to formulate some plan of campaign (which it is hoped will in some miraculous way override all the disadvantages from which electricity suffers) for the popularizing of the use of the current for purposes other than lighting. The President (Mr. S. Z. de Ferranti) wants to see a more general use of electricity in the household at a price (except for lighting) not exceeding 1d. per unit. But wisely he recognizes that there are other obstacles to the realization of his (as an electrician) legitimate aspiration than that of cost; and he suggests that the processes of using gas have been so perfected that the cost to the consumer has probably reached its lowest level. We will not go with him so far as "the lowest level," as it is our belief that we are on the threshold of further substantial developments in connection with the use of gas. Electricity, he acknowledges, is in a different position from gas, as a very small percentage of electric power is obtained in proportion to the power of the coal consumed. In other words, the production of electricity is a most wasteful and uneconomical system of using coal, in regard to both the energy and the constituents contained in the latter.

Generally, the discussion indicated that most of the electricians who spoke considered that cost had an important bearing on the problem; and one speaker confessed that to tempt people to use electricity for purposes other than lighting, it must be supplied as low as ½d. per unit. Another one failed to see how, using electricity for heating, it was possible to economize; and another saw only indirect advantages in it, which have not much weight with that obstinate and much too (for electricians) practical person, the man in the street. There was the same feeling about cooking by electricity—that the way to bring about its general application for this purpose is not very clear. But one man was of opinion that cooking can be done by electricity as cheaply as by any other means. That man has not had any proper experience of cooking in a rational way by gas. Another saw that *bête noire*, the cost of electrical appliances, standing in the way of general adoption; and the cost of wiring was another obstacle of ugly proportions. Assisted wiring, hire-purchase, and the other old ineffectual electrical nostrums were all brought out for an airing from their old cupboards. Another great obstacle, it was pointed out, was water-heating. Electricians know how water-heating shows up the frailty in heating energy of their commodity. There was a kick at variable voltages, and at "scientific" tariffs. An appeal was made for more effective publicity. And electricians were twitted with not using more electricity in their own homes. We have before remarked upon the fact that, if they did, there would have to be a wholesale raising of salaries. While salaries are at their present rates, many of the officials of electricity undertakings bear eloquent testimony to their belief in gas being, for their own household purposes, a more economical agent than electricity. The first conference did not do much in the way of offering original ideas for the removal of the shackles—the shackles of low calorific value, costly construction and installation, and generally high expenditure for the value rendered—from off the feet of the electricity supply industry.

The second number of the "Journal of the Electricity Supply Committee" has now been issued. There is a good deal of self-congratulation about it; and there has been a fair amount of scissors-and-paste work in its preparation. It is not quite so interesting as the first number; but there is a moderation about it in its references to gas on which we compliment the editor. The principal lapse is from the pen of Mr. W. M. Mordey—a Past-President of the Institution of Electrical Engineers, and the author

of the famous term "whiplash" as applied to the effect of bare metallic filaments upon the eye. It is with some surprise that we read this letter from Mr. Mordey. We had looked upon him as being possessed of ideas and technical knowledge far above the penning of paltry and defamatory statement: "People will get to be ashamed of using such a *foul thing* as gas for the lighting of their houses. It will become a mark of poverty, as, in fact, it already is to a great extent." Are those the words of intelligence and of dignity? Will Mr. Mordey kindly explain what he means by the two words which we have italicized; and we shall have much pleasure in discussing the matter freely with him. Elsewhere in his letter he says: "From *my limited experience* in London, I should say that no one lives or works in gas-lighted rooms, except those who cannot afford to put in electric light. I do not here refer to the very poor people who live in small rooms and tenements—this latter class presents a well-known difficulty. A gas-ring or cooker, a prepayment meter, and an incidental light, one or two (all probably put in in the first place without the tenant having to put his hand in his pocket) form a combination with which it will require much skill to compete." One in Mr. Mordey's position should look beyond such a confessed "limited" personal experience. If he does this, he will find that the last issue of the Board of Trade returns shows that 182,833,928,000 cubic feet of gas were sold by the statutory gas undertakings (not including the non-statutory ones) of the United Kingdom in 1910, as compared with 66,613,944,000 cubic feet in 1882. We hope Mr. Mordey will tell us more—he is quite at liberty to do this in our columns—as to what he means by the "foul thing," which is one of Nature's own provisions for the service of man; and how it is that he—a man of recognized intelligence and position—permits himself to give expression to such views on "a limited experience," and apparently without any inquiry as to what is actually proceeding in the large part of the world occupied by the competitor. There are things other than the use of gas of which some people ought to be ashamed.

A little splash has been made in the press over an electric kitchen that the Marylebone Borough Council Electricity Department has fitted up for Messrs. Debenhams, Limited. It is a big installation; and we congratulate the department upon having secured it. Alderman E. R. Debenham is the Mayor of Marylebone. The plant, it is stated, comprises seven large ovens, six hot cupboards, four boilers, &c.; and it has a capacity for 800 meals daily, and is said to be supplying at present from 350 to 400. The charge made for the electricity is ¾d. per unit. Mr. Duncan Watson—a member of the Borough Council—has criticized this ¾d.—pointing out that the actual cost per unit to the department, apart from the capital charges, comes to more than ¾d. That is a serious business; but why Debenhams, Limited, should be allowed to have current at ¾d. per unit for this purpose is not altogether clear. According to the caterer, they appear to be getting some privileged concession, because he asserts that he is "satisfied"—a term that in this connection does not carry much weight—that even at 1d. per unit, it would not be possible to work at a less cost with coal or gas. We are pleased the caterer is "satisfied," but does he know this as a positive fact? We have the best of reasons for doubting it. But why are Debenhams, Limited, being supplied with electricity at 25 per cent. less cost than the caterer is assured that it need be for competitive purposes? If, too, the price has to be at ¾d. per unit for an installation of such dimensions as this, what should be the cost per unit for a cooking installation for a family of (say) only three or four persons? Using the low-temperature slow process of baking, this caterer states that there is a "saving" of about 1 lb. on a 12-lb. joint. Observe that the word "saving" is employed, and not "loss." He does not say what the "loss" is; nor the conditions of comparison. Of late the "loss" has become almost standardized by electricians to about 10 oz. per 5-lb. joint—no matter the characteristics of the joint.

There has been some correspondence proceeding in the "Standard" on the subject of "Electricity and Gas;" and one of the letters is by Mr. Percy Good, whose notions on certain subjects, as disclosed in the columns of the "Electrical Review," have been previously noticed in the "Memoranda." We are not a little astonished that a paper of the position of the "Standard" should devote its space to the dissemination of such a statement as the following—a statement any intelligent person can prove for himself to be untrue. Writes Mr. Good:

> Do your readers realize "that the gas burned in London every day requires and takes four times as much air as the whole of the 7,000,000 people require; and they unfortunately cannot insist on their full amount, and do not get it? The result is one person in ten down with consumption. Tens of thousands of pounds spent on open spaces to counteract this evil. A million of money to be spent on sanatoria. It is obviously not fair to blame the gas for the whole of this; but I do contend that the people who claim all the common sense are those who are too ready to look only on the surface, and do not look at anything from a broad point of view."

Now it is pretty evident Mr. Good only looks on the surface of these things, and does not check his statements. First of all, let us examine the statement that gas burned every day in London requires four times as much air as the whole of the 7 million people. The quantity of air passing through the lungs of a person in twenty-four hours is equal to 400 cubic feet. Hence 7 millions, multiplied by 400, equal 2,800,000,000 cubic feet. In the last issued Board of Trade returns, we see that the quantity of gas sold by the three London Companies totalled to 40,870,395,000 cubic feet in the year, which averages per day 112 millions. As a cubic foot of gas requires 5 to 5½ cubic feet of air for its complete combustion, this average quantity represents 616,000,000 cubic feet, as against the 2,800,000,000 cubic feet needed by 7 million pairs of lungs. What becomes of Mr. Good's statement as to the gas consumed requiring four times the quantity of air needed by the population. His authentic knowledge of physics appears to be sadly defective. We suggested to him once before that he should calculate out the quantity of air that was required for the combustion of coal at the electricity generating stations in London, and see how far they "use up" the air. It seems that, in Mr. Good's brain, he harbours some notion that the 7 millions of people in London cannot get all the air they want, and so 10 per cent. of them, a total of 700,000, are down with consumption. It is not necessary to attempt any contradiction of all these foolish fallacies or statements, nor to deal further with the reiterated libels of this same individual upon Nature, who, according to him, in the provision of fuel, neglects to provide sufficient air for its combustion. It is stranger still that any serious paper should allow itself to be the vehicle for the circulation of such statements.

This same frequent contributor to the press—chiefly the "Electrical Review"—also states that the total cost of lighting and provision of hot water in the household of which he is a member only costs by electricity £10 per annum, together with the expenditure on 2 tons of coal; and he expects his experience, without details, to be accepted by other people. It is all a question of requirement. With regard to water heating by electricity, he makes the sapient assertion that the bath fills as rapidly as any bath. Well, why should it not? One bath will fill as rapidly as any other, providing that the taps are of the same bore, the pressure the same, and the quantity of available water the same. But Mr. Good does not tell us how much he pays per unit for electricity for water-heating. He does not say how often the bath is filled; nor does he proclaim to the world how often the family of three wash their whole bodies. This electrical prophet (who cannot have been to the Smoke Abatement Exhibition to see hot water commence running with the lighting-up of gas) assures another correspondent that in a decade we shall [Percy should speak only for himself] look upon the user of gas in his home in the same way as we now look down on the person whose body is not clean." Knowing something about the heating of water by means of electricity, we are aware that hot-water baths are such luxuries that frequent and proper ablution in them is not possible where only a single bath and electric water-heating arrangement is employed. We venture to say that the three members of the Good family are unable to enjoy immersion in clean hot water on the same morning (say) all within an hour or an hour-and-a-half. Of course, we will not be so ungracious as to say that their bodies are not clean, nor do we look down upon them because their views are not our views, nor their ways our ways. But if there is one thing we should hate, it is being dictated to by the means of heating water, as to when we and the other members of our household are to have our and their baths. Electrical water heating curtails human liberty in this respect.

Personal.

Mr. CHRISTOPHER SAINTY, after twenty-two years' connection with the Windsor Water-Works as Manager (a position he relinquished about six months ago), has been presented with a purse of gold and an address, on retiring from active work.

The marriage took place at Holy Trinity Church, Coventry, last Saturday, of Miss Maude Stevenson, only daughter of Mr. and Mrs. Fletcher W. Stevenson, of Styvechale Lodge, Coventry, and Mr. F. Theodore Freund, son of the late Mr. John Conrad Freund, of Gais, Switzerland. After the ceremony, a reception was held at the residence of the bride's parents; among the guests being the Mayor and Mayoress of Coventry.

Obituary.

We have just learnt of the death, on March 24, as the result of heart failure, of Mr. GILBERT LITTLE, who was known to many of our readers some years ago in association with Mr. Maurice Graham, in the firm of Little and Graham, and still more recently as Chairman and Managing-Director of the New Conveyor Company, Limited, at Smethwick. In this undertaking he was associated with his two sons, Messrs. Matthew and A. B. Little. Failure of health necessitating his retirement from the Company, he was out of business for about four years, at the end of which period he founded the Gilbert Little Company, Limited, of Bradford. The Company was, however, unsuccessful.

Fire-Brick Failures.—According to Mr. J. M. Ogan, of the American Ceramic Society, the permanent increase in volume of fire-brick construction after heating is due to the formation of globule structure in the glassy matrix formed by fusion. The failure of fire-brick at high temperatures has also been investigated. At a load of 50 lbs. per square inch, no fire-brick can withstand a temperature of 1350° C., if the alkali equivalent is more than 0·225 per cent. Silica present in excess of the formula $Al_2O_3 2SiO_2$ adds to the fluxing power of the alkali. Experiments showed that most fire-brick failed at about 125 lbs. per square inch, and that there was no relation between the crushing strength of a brick at ordinary temperature and at 1300° C.

GAS AND ELECTRIC COOKING.

Results of Some Comparative Tests at Brighton.

In the propaganda work of the makers of electric cooking appliances, and of central station electrical engineers who are anxious to increase their dayload by obtaining connections for culinary purposes, there have been many claims made for the use of electricity as a cooking agent which are manifestly extravagant, and which have been put forward in a manner that is derogatory to the interests of gas. Having assumed the *rôle* of active competitors in this field, the advocates of electric cooking must admit that the gas interests have a legitimate right to check electrical claims; and this is being done in several directions, with the result that the tests—carried out by expert cooks, under fair comparable conditions—afford conclusive evidence that there are not those distinctions between the electric cooker and the gas cooker, so highly coloured in favour of the former, that have of late been put forward.

Among the tests that have been made are a number by the Brighton and Hove Gas Company; and we and the gas industry are indebted to Mr. Joseph Cash, M.Inst.C.E., the Company's Engineer and General Manager, for the privilege of publishing representative results. These were made by the Company's cookery demonstrator, Miss Mary Weston, M.C.A., under the superintendence of Mr. P. E. Browne, of the Outdoor Sales Department, who checked the weights and other figures. The names alone are a sufficient guarantee as to the care and accuracy exercised in making the tests, and in stating the results.

The Price of the Two Heating Agents.

In calculating the cost of the gas and electricity used in making the tests, the current prices were taken—viz., 2s. 10d. per 1000 cubic feet for gas, and 1d. per unit of electricity.

Initial Cost of the Cookers.

	Sale Price.
Gas-cooker (Arden Hill's No. 285)	£6 10 6
"Tricity" electric-cooker	£10 3 2
Cost of running for electric circuit	1 15 0
	£11 18 2

The gas-cooker used was Messrs. Arden Hill and Co.'s No. 285; and the electricity cooker was the much-advertised "Tricity." It will be observed from the above table that the initial cost of the "Tricity" electric-cooker is considerably in excess of that of the gas-cooker, although the cooking capacity of the latter is larger than that of the former. In the case of gas-cookers, the Brighton and Hove Gas Company fix them free for their consumers, but for installing the electric-cooker and connecting up with the Corporation electricity system, the Company were charged the sum of £1 15s. (in addition to the cost of the electric-cooker). Therefore the cost to the electricity consumer for an electric cooker and installation is, as shown, £11 18s. 2d., as against £6 10s. 6d. for the type of gas-cooker named. Therefore the cost of the electric-cooker and fixing was about 75 per cent. more than that of the gas-cooker installed in position.

Test with Sirloin of Beef.

The first tests made in the cookers were with sirloins of beef; and the full details are given in the table headed "No. 1 Test." The joints were as nearly similar in every particular as it was possible to get them—that put into the gas-cooker weighing merely 3 oz. less than that baked in the "Tricity" oven. The next thing to be remarked is that the time occupied in cooking the joint in the electric-oven was 35 minutes more than in the gas-oven. But notwithstanding this longer time, it will be observed that the remarks at the foot of the columns of the table show that the joint baked in the "Tricity" oven (small though it was) was "not quite cooked," while the one baked in the gas-oven was "well cooked"—one difference being that the exterior of the joint cooked in the electric-oven was not so well browned as that of the joint baked in the gas-oven. This is the verdict of Miss Weston and Mr. Browne. The fact as to the difference in the result of the cooking has a bearing upon the next point in the record of results. A matter that has struck Mr. Cash, as well as many others in the gas industry, has been the extravagant statements of the electrical people in regard to the relative shrinkage of meat baked in the two forms of oven—always, of course, according to them, to the great disadvantage of the gas-cooker. The results of this and other tests show that the percentage loss in weight is nothing so great with the gas-cooker as is alleged by the electric-cooker advocates. In the first place, we see the weight of dripping is only ¾ oz. more in the case of the gas-baked meat than in that of the electric-cooked meat. The net loss of weight was in the case of the "Tricity" cooker 7¼ oz., as compared with 8½ oz. in the case of the gas-cooker—this result being sufficiently near as to create an equality; bearing in mind that the joint from the gas-cooker was better baked than that from the electric-cooker.

Now we come to the question of consumption and cost—electricity being at 1d. per unit and gas at 2s. 10d. per 1000 cubic feet. As 2 units of electricity were used as compared with 27 cubic feet of gas, the respective costs for cooking the joint were 2d., as against 0·9d., or a saving in favour of gas of 1·1d.

These tests clearly prove: First, that there is not, using both ovens as they should be used, the excessive shrinkage of meat in a gas-oven through evaporation as asserted by the exponents of cooking by the electric-oven; secondly, that the cost of baking in the gas-oven is less than one-half that in the electric-oven; and, thirdly, that the time occupied is less in the gas-oven than in the electric-oven, with better results. The results of later tests confirm these conclusions.

No. 1 Test.—*Dec.* 29, 1911.

Particulars.	"Tricity" Cooker.	Gas-Cooker.	Difference.
Food cooked— Sirloin of Beef.			
Weight before putting in oven	3 lbs. 7 oz.	3 lbs. 4 oz.	3 oz.
Oven started	11.0 a.m.	11.10 a.m.	10 min.
Joint put in	11.20 a.m.	11.20 a.m.	..
Joint taken out	12.45 p.m.	12.20 a.m.	25 min.
Total time taken	1 hr. 45 min.	1 hr. 10 min.	35 min.
Weight of dripping	2¾ oz.	3¼ oz.	¾ oz.
Weight of joint after taking out	2 lbs. 13 oz.	2 lbs. 8 oz.	5 oz.
Net loss of weight	7¼ oz.	8½ oz.	1¼ oz.
Consumption	2 units	27 cub. ft.	..
Cost	2d.	0·9d.	1·1d.
Result	Joint not quite cooked.	Well cooked.	In favour of gas.

A Special Electric Meter.

The next test to which reference will be made was carried out on Feb. 20. The reason of the lapse of a few weeks is that, in the test previously made, an electric meter of ordinary type was employed; and it was considered that, to be absolutely correct, a special meter should be procured to register down to one-tenth of a unit.

Sausage Rolls and Fruit Cakes.

In this second test, six sausage rolls and nine small fruit cakes were cooked. Here, again, there was a saving in time of 22 minutes; and a saving of 1·89d. in the cost—the respective costs being 2·7d. for electricity and 0·81d. for gas. The impartiality of the experimenters is seen by the remarks at the foot of the columns. It is stated that, in the case of the "Tricity" cooker, "The food was excellently cooked; rather too pale;" and in the case of the gas-cooker, "The food was excellently cooked; good colour." This shows that there was a want of browning effect with the former.

No. 2. Test.—*Feb.* 20, 1912.

Particulars.	"Tricity" Cooker.	Gas-Cooker.	Difference.
Food cooked— Six Sausage Rolls. Nine Small Fruit Cakes.			
Oven started	3.5 p.m.	3.5 p.m.	..
Sausage rolls put in	3.27 p.m.	3.17 p.m.	10 min.
,, taken out	3.52 p.m.	3.27 p.m.	25 min.
Fruit cakes put in	3.44 p.m.	3.32 p.m.	12 min.
,, taken out	4.9 p.m.	3.47 p.m.	22 min.
Total time taken	1 hr. 4 min.	42 min. last 4 min. gas off.	22 min.
Consumption	2·7 units	24 cub. ft.	..
Cost	2·7d.	0·81d.	1·89d.
Result	Food excellently cooked; rather too pale.	Food excellently cooked; good colour.	..

Ginger Cakes and Scones.

In the third test, baking ginger cakes and scones, there was a saving in time and cost with gas—in the latter respect in favour of gas to the amount of 1d.; the gas consumed working out to less than half the cost of electricity. In both ovens, the "food was well cooked."

No. 3 Test—*Feb.* 22, 1912.

Particulars.	"Tricity" Cooker.	Gas-Cooker.	Difference.
Food cooked— Nine Ginger Cakes (small). Eight Scones (small).			
Oven started	3.5 p.m.	3.5 p.m.	—
Ginger cakes put in	3.32 p.m.	3.35 p.m.	3 min.
,, taken out	3.55 p.m.	4.0 p.m.	5 min.
Scones put in	3.51 p.m.	3.18 p.m.	33 min.
,, taken out	4.14 p.m.	3.35 p.m.	39 min.
Total time taken	1 hr. 9 min.	55 min., last 5 min. gas off	14 min.
Consumption	1·8 units	24 cub. ft.	—
Cost	1·8d.	0·8d.	1d.
Result	Food well cooked.	Food well cooked.	—

Sponge Sandwiches.

A companion test to No. 3 was made with two sponge sandwiches. Here, again, we have a saving of time with the gas-cooker of 18 minutes, and in cost of 0·66d.

No. 4 Test.—*Feb.* 28, 1912.

Particulars.	"Tricity" Cooker.	Gas-Cooker.	Difference.
Food cooked— TWO SPONGE SANDWICHES.			
Oven started	3.13 p.m.	3.13 p.m.	..
Sandwiches put in	3.35 p.m.	3.25 p.m.	10 min.
,, taken out	3.56 p.m.	3.38 p.m.	18 min.
Total time taken	43 min.	25 min.	18 min.
Consumption	1·2 units	16 cub. ft.	..
Cost	1·2d.	0·54d.	0·66d.

BEEF, POTATOES, CHEESECAKES, &c.

In the next test we have quite a little host of things cooked in each oven—a sirloin of beef, potatoes, cheesecakes, sardine eclairs, and cheese savouries. In considering the time, consumption, and cost figures, it will be noticed that the gas-oven cooked twice as many cheesecakes and cheese savouries as the electric-oven and

No. 5 Test.—*March* 4, 1912.

Particulars.	"Tricity" Cooker.	Gas-Cooker.	Difference.
Food cooked	Sirloin of beef, potatoes, 6 cheesecakes, 5 sardine eclairs, 6 cheese savouries	Sirloin of beef, potatoes, 12 cheesecakes, 9 sardine eclairs, 12 cheese savouries	
Weight of meat before putting in	4 lbs.	3 lbs. 15 oz.	1 oz.
Oven started	2.45 p.m.	3. 0 p.m.	15 min.
Joint put in	3.12 p.m.	3.12 p.m.	..
,, taken out	4.17 p.m.	4.15 p.m.	2 min.
Potatoes put in	3.12 p.m.	3.14 p.m.	2 min.
,, taken out	4.17 p.m.	4. 0 p.m.	17 min.
Cheesecakes put in	3.21 p.m.	3.14 p.m.	7 min.
,, taken out	3.40 p.m.	3.27 p.m.	13 min.
Sardine eclairs put in	3.40 p.m.	3.27 p.m.	13 min.
,, taken out	3.57 p.m.	3.43 p.m.	14 min.
Cheese savouries put in	3.57 p.m.	3.44 p.m.	13 min.
,, taken out	4.12 p.m.	3.57 p.m.	15 min.
Total time taken	1 hr. 32 min.	1 hr. 15 min.	17 min.
Weight of joint, dripping, &c., when cold	3 lbs. 3 oz.	3 lbs.	3 oz.
Net loss of weight	13 oz.	15 oz.	2 oz.
Consumption	2·6 units	25 cubic feet	..
Cost	2·6d.	0·85d.	1·75d.
Result	Joint not crisp, potatoes uneven in colour, and pastry too pale	All dishes well cooked, and looked very appetizing	

One quart of water boiled during each test; the consumption and cost of same being included in above.

Particulars.	"Tricity" Extension.	Gas Ring on Top of Cooker.	Difference.
Time of starting	3.49 p.m.	3.49 p.m.	..
Water boiling	4. 8 p.m.	3.58 p.m.	10 min.

four more sardine eclairs. There was only 1 oz. difference in the weight of the joints when the cooking started; and the difference in the loss of weight was 2 oz. The gas-oven proved its greater capacity, its ability to save time, and the lowness in cost—2·6d. for electricity, against 0·85d. for gas (or 1·75d. less). Upon all this comes the report that the joint cooked in the electric-oven was not crisp on the exterior, the potatoes were uneven in colour (they were almost like baked potatoes), and the pastry was too pale; whereas, with the gas-oven, all dishes were well cooked, and looked very appetizing.

WATER BOILING.

In the lectures and literature of the exponents of electric cooking, they speak as though the whole of the cooking of a household is concentrated in the baking of meat. As every housewife and cook knows, it is not so. Boiling takes a considerable part; and therefore the following test in water boiling will be of special interest. It will be seen that it is both a time and money absorbing operation. To boil a quart of water on the "Tricity" cooker in twenty minutes took 0·3 unit of electricity, against eight minutes with 2 cubic feet of gas—the respective costs being 0·3d. and 0·068d. Boiling water at 0·3d. per quart is, considering the quantity required for kitchen and other purposes, somewhat expensive.

Particulars.	"Tricity" Extension.	Gas Ring on Top of Cooker.	Difference.
Quantity of water boiled— ONE IMPERIAL QUART.			
Started	5.5 p.m.	5.5 p.m.	..
Water boiling	5.25 p.m.	5.13 p.m.	12 min.
Consumption	0·3 unit	2 cub. ft.	..
Cost	0·3d.	0·068d.	0·23d.
Ordinary kettle would not boil at all on the electric extension cooker, owing to bottom surface not being absolutely flat. Water was put into "Tricity" special six-pint saucepan. Top open.		Ordinary six-pint saucepan used. Top open.	.. ..

The influence of such an expense as is incurred in boiling water on the cost of cooking is too important to be ignored, as the electricians would have it be. It is also important to note the point made in the table as to the necessity for the bottom of the vessel containing the water to be perfectly level when using the electric method of boiling, as otherwise disaster will ensue through a frightful waste of electric energy without accomplishing the result required. That the bottoms of kettles and saucepans for use with an electric cooking outfit will keep perfectly true in the hands of a servant is a matter that one, from painful experience, may reasonably doubt.

WHAT ELECTRICITY MUST BE SOLD AT FOR COMPETITION PURPOSES.

Now we come to the final table, in which Mr. Cash has worked out the costs at which electricity must be sold in order to compete with gas at 2s. 10d. per 1000 cubic feet, without taking into account any of the other factors that tell in favour of gas and against electricity.

Test.	Price at which Electric Current would have to be Sold to Compete with Gas at 2s. 10d. per 1000 Cubic Feet.
No. 1	0·45d. per unit.
2	0·30d. ,,
3	0·44d. ,,
4	0·45d. ,,
5	0·32d. ,,
To boil water	0·23d. ,,

The saving in time is not an unimportant factor in the household. While cooking is going on, attention must be bestowed upon it by the cook; and the longer the time occupied, the less time is there for the busy housewife or servant in the ordinary household to devote to other duties. Multiplying the extra time by meals and days, it would amount to a very considerable figure over a period. The same with the cost. The extra pence spent in a day on electric cooking of all kinds, multiplied by 365, will mean a substantial sum at the end of a year. Even if electricity were supplied at ½d. per unit for cooking, with gas at 2s. 10d. per 1000 cubic feet, gas would then, as the above table shows, be able to hold its own, and especially for boiling water, for which purpose electricity would have to be supplied at less than ¼d. per unit—the inconvenience still remaining of the longer time occupied in performing the work. Of course, the excessive cost of boiling water puts all food requiring boiling, such as vegetables, soups, fish, meat, and fowl, out of the question, so far as the use of electric current is concerned.

RELIABILITY.

There is the further question of reliability. Electric cooking apparatus is not so reliable as gas apparatus, the cost of maintenance and repairs is more, the cost of renewals (particularly of the heating elements) is more; and, as is well known, electricity has the unhappy reputation of failing at most inopportune times. On all grounds, therefore, gas wins.

We may remind readers, in connection with Mr. Cash's final table, that in the "JOURNAL" for March 5 (p. 666), reference was made to some tests on cooking by gas and electricity that had been made by Herr Friedrich Meurer, the Chief Engineer of the iron-works of that name at Cossebaude, near Dresden. He also made calculations (which we converted into the English equivalents) as to the price at which electricity would have to be sold to compete for cooking with gas at the prices mentioned; and they more than corroborate those found by Mr. Cash. The figures were as follows:

Gas at 2s. 4d.	..	Electricity 0·292d.
,, 2s. 10d.	..	,, 0·354d.
,, 3s. 4d.	..	,, 0·417d.
,, 3s. 10d.	..	,, 0·478d.
,, 4s. 8d.	..	,, 0·584d.

These figures are really worse than Mr. Cash's for electricity, having regard to the prices of gas. However, it will be seen from them that the price charged for current must be considerably below its prime cost in order to allow of electric cooking competing with gas cooking.

The late Mr. Thomas Winch, the Chairman of the Rochester, Chatham, and Gillingham Gas Company, whose death was recorded in the "JOURNAL" for the 9th of January last, left estate of the gross value of £59,650, with net personalty of £53,286.

Arrangements are being made for Mr. Jacques Abady to deliver a lecture at the next meeting of the North of England Gas Managers' Association, on "Light and Competition." Mr. R. Nelson, of the East Hull Gas-Works, is also to read a paper.

Since the discovery that frozen water-pipes could be thawed out by passing a rather heavy current of electricity through them from the nearest electric light mains, this neat method has met with very wide application. An electric light company of New York City has lately been kept very busy on this winter work, utilizing as many as five trucks equipped with the special apparatus required for thawing. Upwards of 400 cases, for the most part pipes less than 1 inch diameter, have been handled in a single week. The average time for the current to do its work has been about 30 minutes. Where a convenient connection can be made to the electric light main, a water rheostat is employed to control the strength of current.

PROFESSOR VIVIAN LEWES AND HIS SMOKE ABATEMENT LECTURE.

THE lecture delivered by Professor Vivian B. Lewes, on "The Relation of the Gas Industry to Smoke Abatement," at the Smoke Abatement Exhibition on Monday evening last week—the text of which was published by us the following day (p. 867)—was well attended. The President of the Institution (Mr. R. G. Shadbolt) was in the chair. In a few remarks, he introduced the popular lecturer to those of the audience who are not of the gas profession. The ladies who accompanied the members of the latter knew him well by repute, and so hardly needed the introduction. But there were many there who were strangers among those ordinarily met with where those of the gas fraternity customarily assemble. The exhibition has again brought gas engineers and the manufacturers of gas appliances into close touch. It was so at the reception by Mr. and Mrs. Shadbolt, and at the lecture. They were at the latter assembled to hear of matters of common interest. This is a trend of the times. This intermingling reminded of the words of the new President of the Society of British Gas Industries (Mr. Corbet Woodall) at the recent meeting: "The obligation under which gas companies were to manufacturers represented in the Society pointed to the wisdom of bringing closer together the companies who were the manufacturers' chief clients and this Society, in order that they might be mutually helpful."

Professor Lewes showed, and the remarks which followed his lecture did the same, how they were mutually helpful in the campaign for the suppression of the pollution of the atmosphere by smoke. As to the lecture, the old free and easy style, lucidity, and wit brought the Professor fresh laurels of popularity. His illustrative experiments were simple and readily understood; and the lay minds present must have gone away with an increment to their stock of knowledge. They were shown that the atmospheric evils from which humanity suffer produced by the combustion of the raw fuel coal have their birth in wasted substances of value which could be saved, and ill prevented, by the carbonizing of the coal in the retorts of gas-works, using the resultant gas or else the coke as fuel. Professor Lewes is still keen on gas-works making coke more after the nature of coalite for domestic consumption; but the gas-fire has been brought up to such creditable efficiency that he places it on a properly high plane as a sanitary and convenient means of warming a dwelling-house or other premises. He showed what a myth, with the modern gas-fire and its convenience in labour-saving, and use only as and when required, is the notion that it is so much more expensive than the coal-fire. He illustrated further why, with the modern gas-fire, in which the defects of the old form (born of their designers' misconception) have been suppressed, the temperature efficiency is so much superior to the old coal-fire. It was a most appropriate lecture, carrying us from the crude application of fuel, with all its waste of heat and substance, to the more perfect method of heating, by either the gaseous or the solid product of the coal, and the saving of all the other constituents which are of value, and which, in the former mode of use, simply escape up the chimney, so being lost, except in relation to their mischievous and undesirable effects. Our electrical friends may urge the use of electricity. They cannot escape the truth that most of their generating stations are contributing to both pollution and waste; they cannot escape the truth that carbonization of coal and gas production must continue if the world is not to be robbed of those 140 or so indispensable commodities, including the aniline dyes, that are produced from gas-works residuals.

All who heard the lecture enjoyed it immensely, and were the better for hearing it, as are those who have read it in our last week's issue. A vote of thanks was passed to Professor Lewes. It was proposed by Mr. Lawrence W. Chubb, the Secretary of the Coal Smoke Abatement Society, who took the opportunity of expressing the gratitude of the Society to the combined gas companies and manufacturers of gas appliances for their wholehearted support and assistance in organizing the exhibition. The motion was seconded by Mr. F. W. Goodenough, who praised the lecture, but—whole-souled as he is for advertising the applications of gas for all heating purposes—was a little sorry Professor Lewes had not adverted to the place cooking by gas had taken in ameliorating the atmospheric conditions, and to the fact that both gas and coke are taking a growing part in the provision of hot water. He also spoke of the trouble experienced by the old make of gas-fire through high-temperature convection; and twitted Professor Lewes with being a bit in arrear of the modern gas-fire by only giving it credit for delivering about 60 per cent. of the heat energy of the gas into the room in which it was used. Mr. Goodenough was right in claiming 70 to 75 per cent.—50 per cent. and upwards in the shape of radiant heat, and 25 per cent. in the form of convected heat, with 20 to 25 per cent. passing up the flue. He also pressed as an essential the importance of the scientific fixing of gas-fires. And, further, he narrowly got on to controversial ground over the old subject of the taxing of exported coal—pointing out that a good proportion of it was utilized for gas supply provided by British capital. The President of the Institution also had a few words to say about the balance of demand between coal and coke that Professor Lewes advocated gas suppliers should cultivate; and he suggested that just at the present time many gas suppliers were not particularly anxious to be pressed for coke. The acknowledgment by Professor Lewes of the vote of thanks brought from him the remark that he had thought he was taking a very good average when he spoke of 60 per cent. of the energy of the gas being delivered by a gas-fire into a room. He considered that the idea of using coke had got to be pushed home for all it was worth; and this would create a demand for both gas and coke. Gas suppliers in this connection had an opportunity for doing this at the present time that, in the same measure, might never return again. The audience could not part without thanking the President of the Institution not only for presiding, but for his kind reception and hospitality during the afternoon. This recognition was made on the motion of Mr. A. E. Broadberry.

A LESSON IN ELECTRIC COOKING.

By E. S. MEMORANDA.

THE electric punkahs were whirring and the electric ventilating fans were briskly performing their functions in the prettily decorated side-show of the Electricity Publicity Committee, at the Smoke Abatement Exhibition, at the Royal Agricultural Hall. The decoration of the walls of the apartment struck visitors as being most artistic; it is pleasing, and must appeal strongly to lady visitors. Mere man, who cares little for these things when in search of technical interest, looked about for the domestic electrical appliances, and found them crammed together, between the corner allotted to the little blue-garbed orchestra (the components of which are not all small) and the cooking department, alongside the wall of which were ranged a few examples of electric-cookers, with their switch-boards, &c., which are enough to frighten the maids-of-all-work in the residences of Suburbia. A little counter arrangement at the end is called the "Restaurant," where everything that is provided from it hot or warm is brought into that condition by means of electricity.

Cooking was proceeding in one (perhaps more) of the electric-ovens; and despite punkahs and fans, a blue mist and the smell of cooking—just the same old-fashioned mist and smell as are usually found in the ordinary kitchen—pervaded that end of the place. Cooking by electrically derived heat does not—Nature has not endowed it with any special exemption in these matters—avoid those conditions any more than can cooking by other means. However, this was not the time when the daintily-dressed lady cooks were busy, nor were the conditions altogether to the liking of the male investigator, to inquire into the subject of electric cooking.

Later on, the opportunity arrived. The lady demonstrator who invited attention was courtesy itself; and she and the other intelligent, well-educated lady demonstrators were the antitheses of the cook or cook-general of the suburban dwelling. What the former can do, the latter would never be trained to do. The idiosyncrasies of the latter are strong and ineffable. She will do those things that she ought not to do, and she will leave undone those things that she ought to do. And there is no help for it. The predecessor of the existing maid bore the characteristics, and any successor would in all probability be precisely the same. They are inherent and ineradicable. The mistress, the purse provider, and the family, often prefer to put up with indifference to waste by the maid rather than fly perhaps to worse evil. The scope for much waste is provided for her by electric cooking. Every mistress knows the maid who will for hours keep the kettle singing over a gas-ring on the top-plate when hot water is not wanted. She will do the same with the current-absorbing elements on the top of the electric-cooker, which elements, it was noticed, on one of the cookers at the exhibition were becoming stained by use. There is the oven again. This may be, just as in the case of gas, a source of luxuriant waste; but the waste will be more expensive than in the case of gas.

We stood in front of a black-cased oven.

"Here we have the choice of three heats, for the oven and top-heating arrangements," says our courteous instructress, pointing to the switch-board arrangement, which would frighten any but a highly intelligent Girton sort of girl.

"What ready indication has the servant that the current is on or off?"

"When it is on, there is a little light at the indicator to show that; and when switched off, the word 'off' appears where the light has been showing."

Thoughts flew to the genius preparing the dinner at home; and it was wondered how often she would notice the diminutive signal light or the word "off." Then the other switches were about to be explained when one of the "off" indicators, it was found, had become a little disordered, and would have to be put right—presumably by an expert electrician. However, more was heard about "full on, half on, and so on." Instruction followed as to the necessity, for economy sake, to be very precise about the "full on, half on, and so on." The oven-door was opened, but quickly closed, for the sake of preserving the "full on" heat, as the oven was being prepared for cooking.

The punkahs and the ventilating-fans were spinning round merrily; interest only kept the writer in front of that oven.

"I like to have the current 'full on' for about half-an-hour before commencing cooking, so as to get the oven up to the proper temperature before putting in the meat. And then afterwards—say,

about every twenty minutes—I alter the switches according to the condition of the temperature."

The listener heard and admired; and wondered if £20 or £22 a year would tempt his instructress to suburbia to exercise her high art and be a sort of maid-of-all-work. He doubted it. Long experience and sad reminiscences show that ladies with such intelligence and such gifts are not to be obtained for such work at even the maximum wage of the suburban domestic.

However, high proficiency in the art of saving meat from shrinking through evaporation is only obtained with electricity by a studious regard for the switches and the master's pocket.

"Cooking has been done hitherto at far too high temperatures," remarks our instructress. "Lower temperatures, and longer cooking periods, are what are required—to prevent shrinkage of meat by evaporation."

"What do you allow (say) for a 6-lb. joint?"

"Half-an-hour for heating up the oven; twenty minutes for each pound of meat; and I like to give twenty minutes beyond."

"That is 170 minutes altogether?"

"Yes; say, three hours."

"How much electricity would you use?"

"For a six-course dinner about 4 units."

The writer knew the same work could be easily done with a gas-cooker for about 1d., with gas at 2s. 6d. per 1000 cubic feet, and for less with the development of modern improvements. But he did not say so; nor did he remark upon the expenditure of time occupied in preparing for and cooking the joint by electricity—6 lbs. in about three hours!

The fair instructress was asked whether she had ever cooked with an enclosed tin in a gas-oven. She had not.

"Are those tins ventilated?" she inquired.

"There is a ventilating-slide in them."

"That is all right, because, as you may know, poisonous fumes come off during the cooking of meat, and that is why a hole is made in meat pies."

This was getting interesting.

"But this particular electric oven does not appear to be ventilated; so that the meat is being cooked in vaporous atmosphere in which there are the so-called poisonous fumes from the meat?"

"There is more space in the electric-oven than in the meat pie."

"Thanks; and good-night."

GAS-COOKING DEMONSTRATIONS AND LECTURES

The gas-cooking lectures and demonstrations by, and under the direction of, Miss Helen Edden, at the Smoke Abatement Exhibition, are being well patronized—more especially during the evening, when often there is not standing room. The audiences have displayed the keenest interest, and have followed the lectures with undivided attention. It is very gratifying to learn that the lowest attendance was 70. The afternoon audiences have averaged about 150; and at the two evening lectures between 400 and 500 people—quite as many men as women. The subjects included roasting and grilling, the baking of cakes and pastry, and various quick breakfasts and luncheons, cooked in thirty minutes at a cost of ½d. The two competitions for men only on the opening day created much amusement and interest. A quick breakfast, consisting of toast, bacon, poached eggs, and tea, formed a menu. At a given signal the competitors started, and the first tray, with the completed breakfast, was cooked and served in ten minutes. Last Saturday afternoon, at four o'clock, a quick luncheon was cooked by Miss Edden before a large audience. The time taken was forty minutes. Menu of luncheon: Rolls, baked stuffed fish, three pigeons on croutes, peas, and sautés potatoes, grilled cutlets, tomatoes, brown sauce, cassolette pastry, fricassée of prawns, cheese straws. The cost for cooking was not more than ¾d.—rather under than over. Three sweets were prepared and cooked in thirty minutes at the three o'clock lecture. The men's competition attracted audiences of 200 to 300 people, and numbers had to be refused admission. The results of the competition were so very good that a final heat is to take place at 6.30 on Wednesday evening next, when the winners in the previous competitions will cook a quick lunch, consisting of two dinner rolls, chop and tomatoes, with boiled potatoes. Prizes of decorated cakes made by the demonstrators are to be awarded afterwards.

Under the title of Combustion Improvements, Limited, a Company has been registered with a capital of £25,000, in £1 shares, to carry out certain agreements made between Mr. H. Edmunds and Radiant Heating, Limited—a Company formed to work Professor Bone's patents.

The Nicholl pipe coating has been devised and extensively used by the Laclede Gas Company, of St. Louis, where serious corrosion is anticipated. It is applied by covering the pipe with alternate layers of hot pitch or some other suitable compound and paper wound spirally on the pipe. Some tests to determine the efficiency of this coating were made under the direction of Mr. J. D. Von Maur, the Company's Superintendent of Distribution. He constructed a gridiron consisting of two headers between which eight lengths of pipe, each 12 feet long, were connected. This grid was then placed in a locality where electrolysis was taking place; and it was found that the pipes covered by the coating were much better preserved than the others.

WORKMEN'S COMPENSATION: A FEW HINTS.

[Communicated.]

The Workmen's Compensation Act of 1906, as is well known, has much increased the trouble of dealing with men who have met with accidents. The writer has been greatly impressed with the difficulty of combating the undoubted malingering tendencies of a certain type of men whose main idea is to extract as much as possible from their employer, even if only slightly injured. It is a fact, too, that some men of steady and industrious habits will, if temporarily disabled for a few months, gradually develop into confirmed malingerers. Whether it is a result of well-meaning advice repeatedly dinned into their ears by their friends, whose main idea is to induce the injured man to obtain the maximum amount of plunder from his employer, or whether it is a result of enforced idleness which, if prolonged for any length of time, is bound to have a deteriorating effect on the steadiest character, the fact remains that, in a great many cases, these men will not willingly return to work until forced to do so. The writer is induced to write this article, not from any consciousness of the possession of special knowledge of legal matters, but rather from a desire to record a few practical hints, suggested for the most part by legal advice in cases which have come under his direct observation.

Firstly, in arriving at the correct amount to pay an injured workman, it is known that the figure will vary between 10s. and 20s. In ascertaining the amount to be paid, it is not sufficient to pay the workman half-pay based on the wages he was earning at the time of the accident. It is essential to search the wages-sheets for the previous twelve months, and so obtain his average weekly earnings over this period. In some cases, it may be a considerable labour to undertake in the case of a man who is only expected to be absent for a short time; but there is no way out of it.

The writer has on one or two occasions found that a man has been paid half pay based on the rate of the grade in which he was working at the time of the accident. Later, when challenged by the man's solicitor, it has been necessary to calculate his exact earnings during the previous twelve months, only to discover that the payment has been insufficient, with the result that it has been necessary to pay, in a lump sum, such amount as will make up the difference between the sum already paid and that which should have been paid in the first place. To say the least, such a step should have been quite unnecessary, and, of course, has a very suspicious appearance in the eyes of the man and his solicitor. The only moral to be drawn is that in every case of accident the man's exact earnings for twelve months must be ascertained.

Secondly, in the case of accidents to casual workmen, it is impossible to arrive at the above figure. The man himself will rarely, if ever, know his twelve months' earnings. He will have some hazy idea, which will be much exaggerated should he meet with an accident. It is, of course, quite possible to find out the total amount paid him by the company or firm for whom he was working at the time of the accident. This figure is, however, of no use, if, as is probably the case, he has also worked for other employers. In one case in which this question arose, and which was finally settled in Court, the man stated that his average earnings amounted to more than double the sum which he was paid on meeting with an accident. On being challenged to prove his statement, he was quite unable to do so. This was a case in which the man had met with the most trivial injury, and had attempted to bluff his employer into either paying £15 compensation or spending a larger sum in defending the case in Court. The latter alternative was taken, with the result that neither the man nor his solicitor put in an appearance.

It being impossible to ascertain a casual hand's average earnings, it is the wisest course to base the payment upon the yard labourer's rate. If dissatisfied, the man will complain, and so enable inquiries to be made from any other employers for whom he has worked. In only one case out of many has the writer received any complaint of the inadequacy of the payment; and in this one instance inquiries failed to show that the payment was insufficient.

It sometimes happens that a man on accident pay will be, by reason of his being a member of two clubs, in receipt of more money while *hors de combat* than when at work. This fact has a tendency to introduce malingering on the part of such workmen, though, on the contrary, it is usually the very men who provide against misfortune who are least likely to take advantage of their employer. The fact remains that a close eye must be kept on the men who are absent on the accident pay-list. The writer has found it a good plan to appoint responsible men, usually foremen, of good character, to visit accident cases in the district in which they live. At least once a week a written report is made out by the visitor, and handed to the head foreman. As soon as the report of the visitor himself indicates that the man is fit for light work, the company's doctor is instructed to visit him, and certify whether or not he is fit for light work—such as brick-cleaning, &c. Visits of this sort are an excellent check against malingering, especially as the general character of the visitor is a guarantee against any undue sympathy with the absent man. Should the man be capable of visiting the doctor, it is necessary for him to produce a certificate weekly before receiving his accident pay.

It often happens that a man is able to do light work some weeks

before he is fit to recommence his ordinary duties. The doctor is in all cases requested to indicate when such light work should commence. Should the workman object—as sometimes happens—no half pay is forthcoming. On the other hand, as soon as ever work is commenced, however light, full pay at the yard labourer's rate is given.

A workman who has received some injury is often anxious to have the weekly payments redeemed by means of a lump sum. In such cases a note of warning should be sounded; for in the Workmen's Compensation Act it is provided that, to prevent agreements from being made for lump sums which are unfair to the workman, the Court is given power if it thinks that the agreement ought not to be registered—either (1) owing to the inadequacy of the amount of compensation, or (2) owing to its having been obtained by fraud or undue influence or other improper means—to cancel the agreement or make such order as it thinks just. Consequently, it is distinctly unwise, however much pressed by the man to "let him have £10 or £15 to settle it," to attempt to redeem the weekly payments. In all cases such a step should only be taken through the man's solicitor. Even then, though it is not so likely to happen, the Court has power to set aside any agreement made between the employer and the workman through his solicitor.

In conclusion, it cannot be too strongly emphasized that a man who receives serious injuries in the course of his employment should be treated in a fair and generous spirit. Unfortunately, the Workmen's Compensation Act of 1906, owing to the inclusion of certain clauses which weigh heavily on employers, has caused much bitterness between employers and workmen. The consequence of this is that the employer, on the one hand, feeling the severe tax imposed upon him, attempts to reduce his obligations to a minimum, while the workman, on the other hand, is equally insistent in exploiting to the full his claims under the Act.

VERIFICATION OF METERS, AND THE MEASUREMENT OF GAS FOR SALE.

By F. Coe, of Nottingham.

From time to time, official inspectors of gas-meters are called upon to decide, either by stamping or rejecting, what may be deemed to be legal or illegal machines for the measuring and registering of gas for sale, so far as is provided by the laws regulating their use. Decisions may, however, be appealed against; but disputes respecting the correctness or incorrectness of the register remain subject to the decisions of other inspectors to be named by the Justices of the Peace having jurisdiction in the districts where the meters shall have been tested. These are the principal facts with which I set forth my views, particularly relating to the introduction of compensating indices for the registering of gas for sale measured at higher pressures. To lawfully decide what are legal or illegal machines for measuring and registering gas for sale is, to my mind, a more far-reaching subject (with existing regulations) than is apparently supposed to be the case.

Inadequacy of Present Regulations.

Whether or not manufacturers of gas-meters and sellers of gas would welcome a more adequate and uniformly established official procedure for the verification and stamping of gas-meters, it ought never to be represented that the present law has in any way prevented the production, or stamping, of such meters as the sellers of gas have called for, or that the manufacturers of meters have not produced machines suitable to all purposes in the direction desired. Rather it has been made to appear that the present law has been too long inadequate and too obsolete to ensure the stamping only of such meters as have been desired. Of this, however, so very much will depend on the interpretation of the law to suit different purposes.

With a new consolidated law for the regulation of the measuring of gas for sale, and a reasonably practicable, adequate, and uniform system of verification enforced (so far as is necessary), all parties might then regard the sealing of meters as a guarantee of the correctness of their registering contrivances. But it is possible even then that something which was desired had not been obtained. On the other hand, it is improbable that reasonable regulation will be disregarded where it has been shown for so long to be fairly practicable to apply. Of this, the direct concern of inspectors of gas-meters should be: Uniformity of procedure, with more definite rules and regulations to guide them in arriving at a proper decision, but not so conclusive as to dispense with discretionary judgment of competent inspectors, not being inconsistent with the law.

Gas-Meters as Definite Measures.

With the law as at present, gas may be measured for sale by means which are capable of both measuring and registering correctly (within certain limits fixed for error) the number of units passing through. For purposes of the law, the words "machine" and "gas-meter" are interpreted to mean one and the same thing, and the "cubic foot" as being the only legal standard or unit of measure for the sale of gas by meter. Of necessity, the standard or unit of measure is a definite measure of capacity defined at prescribed conditions, by means of which unit the Government model gasholders (measuring multiples and decimal parts of the unit) were defined at atmospheric conditions.

It is evident by the present law that gas-meters also were to be defined measures of capacity (as near as was considered to be practicable) to pass a denominated amount of the standard or unit of measure per revolution of the meter, which is to be marked in legible letters and figures on the outside of it. Hitherto, the revolutions of the measure, the index-testing dial, and the register have been regarded by all parties as not permissible to vary at different conditions. If not so, or if otherwise permissible with the present law, then all the requirements of the law as to the denomination of capacity per revolution are meaningless, or they are now obsolete and inapplicable to present conditions, and are therefore, intolerable with the measuring and registering of gas for sale at higher pressures than the onetime limit of 3 inches of water pressure.

Pressure Standard.

The law does not specify a standard pressure for the measuring of gas for sale. Gas has at all times been supplied at varying pressures above that which is laid down for the purposes of the verification of gas-meters—to the advantage of the buyer of gas. However, there must be a limit to the disregarding of supply pressure. A varying scale of charges according to pressure is not devoid of practical difficulties; and it is not just to the seller of gas to suppose that each revolution of the measure is to represent but the denominated amount at all conditions of pressure. On the other hand, with an increased charge for an increased pressure and varying conditions, buyers of gas may not obtain that for which they are charged.

With the law as at present, it is questionable if index compensation is admissible, or that contrivances may vary the register more than the range permissible for error fast. Existing provision appears opposed to compensation by register for difference due to pressure commensurate to a presumed standard, even supposing the law as to the denominated amount per revolution of the measure was not considered.

To admit of a varying number of revolutions with the same register at different conditions, with a measure of denominated amount per revolution, would be inconsistent with principles previously recognized as necessary to obtain. This is but one of the problems inspectors have to decide where compensating contrivances are contained in meters submitted for verification and stamping. Inspectors do not necessarily solve the problem or rid themselves of their responsibility by following advice which could not be applied generally. For instance, their decisions may not be lawfully agreeable with inspectors of other districts in cases of dispute. Rightly or wrongly, inspectors remain responsible for their decisions according to the present law.

It is also questionable to suppose that the pressure standard for verification was conceived by the framers of the law as ever applicable to the measuring of gas for sale only in so far as they may have provided for. It is so obviously an essential standard nearest approachable to that at which the Government Models and Inspection Standards were defined; being one essential to work a meter and at the same time permitting of the least amount of error due to pressure, and one which would best ensure the smoothness of the working of meters in all conditions of use. Such a standard cannot be said to have represented the conditions of supply at any time. It is the least practicable pressure both in use and with the verification of meters, approachable to the true standard—atmospheric conditions. If the least practicable pressure is really admissible as a standard for the measuring of gas for sale, there is no reason (with the practicability of compensating registering devices) why the true standard conditions may not be presumed for the calibration of such machines. The problem here is: What may inspectors presume the standard to be for the verification of these machines?

The present pressures of supply have of necessity been adopted and conceived of recent times, and were not conceived at the time when the Sales of Gas Act was framed. The framers of the Act may, however, have taken into consideration such pressure conditions as were regarded by them as ever likely to prevail. This to some extent may be argued as probably the reason why the turn of the scale favoured the buyer of gas, inasmuch as the then—presumably supposed—limit of 3 inches water pressure would not produce a greater error slow from the true standard than 1 per cent. for the following reasons.

A wet-meter of the non-compensating type set to register the permissible limit of 2 per cent. fast at normal water line, and to register 2 per cent. slow at low water line under verification pressure conditions, might be considered to be not only an equitable measure to both buyer and seller of gas, but an ideal setting also for the practical purposes of use. But with an alteration of the pressure to 3 inches of water, and the volume corrected to atmospheric conditions, such a meter would have varied from the true standard measure to as much as 3 per cent. slow at low water line. Hence, maybe, the framers of the Act did have in mind losses due to measuring gas at all conditions of pressure which they may have considered as ever likely to arise in practice, and maybe they did so purposely provide that meters would not be likely to vary from the true standard measure beyond the limits fixed by them for error—3 per cent. slow.

With such a construction admissible, they in their judgment did not, evidently, consider it either advisable or necessary to specify a standard pressure for the purposes of measuring and registering gas for sale; and, therefore, with the present-day

conditions of supply the law is evidently inadequate, obsolete, and inequitable in this respect.

Utility of Permissible Error.

At the time when the Sales of Gas Act was first put into force, the prevailing type of meter was the ordinary "wet." The "dry" meter was not then so favourably regarded by sellers of gas. Doubtless, most of the 2 per cent. permissible error fast was then considered to be necessary to compensate the seller of gas for loss due to evaporation of water which defines the extent of the measure in wet meters. With a correct meter in no degree registering fast, a decrease of water means excess quantities being delivered with each revolution of the measure. The limit tolerable by law to register against the seller of gas was fixed at 3 per cent. slow. The 1 per cent. turn of the scale favouring the buyer of gas is here justified, inasmuch as the seller of gas has power to maintain the water at a proper level, although the average fast and slow in practice may be said to be about equal with both buyer and seller of gas, while providing an emergency margin in extreme cases of inattention such as the seller of gas chooses to admit, without inconvenience to the buyer of gas, or the register varying from the true standard measure more than was provided for. On the other hand, sellers of gas bear the cost of maintaining the water at a proper level in meters; but it has its advantages with more than a corresponding disadvantage to the buyer of gas. So much so, that had the present-day types of water compensating meters been then in general use, there can be little doubt, as an equitable concession, that the permissible error fast would have been fixed at less than 2 per cent. so far as concerns wet meters.

Indeed it has been for a long time practicable, and at all times permissible, to set wet meters to register the limit fast with no probability of the water line affecting the register at any time. I am nevertheless of opinion that the present amount of permissible error fast and slow is still a necessity for the practical purposes of dry meters. True, the same reasons do not apply with wet and dry meters. Experience has shown that even when dry meters are set to register the limit slow, they are not so very long before they are registering on the fast side. There are exceptions where dry meters register slower after but a short time in use, from various preventable causes; but ultimately there are serious losses to sellers of gas with dry meters where a good supervision of these matters is not exercised. Nevertheless, on the whole, with good organized supervision, it is doubtful if the turn of the scale really does favour the buyer of gas beyond what is gained in density through measuring gas at increased pressure. It is also doubtful if the limits fixed for permissible error could be improved upon, so far as may be applied to dry meters.

Compensating Indices.

Since the time when the Sales of Gas Act was first made operative, many contrivances have been introduced for the measuring of gas for sale, generally in the interests of the seller of gas. On the other hand, there has been the ever-increasing pressure of supply favouring the buyer of gas. However, machines have now been introduced to compensate the seller of gas for the loss due to increase of pressure; and maybe to a greater extent than the law permits. Be all this as it may, I am of opinion that such machines are now almost essential in the interests of both the buyer and the seller of gas with modern conditions of supply, for reasons already stated, and that authoritative provision is essential for their verification and stamping.

What is perhaps most notable with these machines is that they have already been officially stamped, and thus recognized as measuring and registering machines within the present law (apparently regardless of their capabilities), because they conform with present procedure, which cannot apply to these machines so far as the purposes of the machines are intended. From a point of view hitherto recognized as essential to obtain, as to the relation of the measure to the register, such meters could not be stamped under the present law. They are admittedly devised to vary the register at different pressure conditions with no regard to the number of revolutions at these conditions. Whether the revolutions of the measure may be varied in number, at different conditions of pressure, beyond the amount fixed for error, is a problem some inspectors have presumed to decide by stamping. To my mind this is a most questionable procedure with the law as at present constituted.

Application of Present Law.

There is no authoritative law for the guidance of inspectors of gas-meters by which they may prove the correctness or incorrectness of compensating indices, as such. The rules which ordinarily apply would not reveal the capabilities of such contrivances. Moreover, in cases of disputed registration, it would be useless to apply the ordinary course of the law by submitting the matter to an inspector of gas-meters. He would possess neither the power nor the means to decide what would be commensurate to official conditions at other pressures, as shown by the machine. Further, the law as to the register being *primâ facie* evidence of the amount passed, and ordinary tests, would prove nothing. It might, therefore, be that contrivances which were capable of varying the register with the pressure, with no authoritative means of proving their correctness or incorrectness, would be regarded as unsatisfactory at law, and that inspectors of gas-meters had no right to approve of them by stamping.

Law and Practice.

Notwithstanding anything I have stated as to what I believe the law requires with the relation of the measure to the register of meters, I have always been of opinion that it does not much matter what the amounts per revolution are, either as denominated or delivered, so long as the amount passed is correctly registered, as proven officially. It has never been really practicable to officially prove the correctness or incorrectness of the amounts per revolution of meters in the finished state. It is another matter with meters in the hands of manufacturers and repairers of meters. I have frequently, in my experience, known of inequalities of measuring wheels necessitating the introduction of varying gear with the same size meters, so as to cause the index to register correctly, and at the same time permit of a water range such as would prove satisfactory in use. Such variations are legally permissible where the denomination of the capacity per revolution is corrected accordingly. There are no legal standards of capacities per revolution, and the proving of the capacities per revolution of meters is not officially practised, for the reasons which I have already stated; and therefore makers have not varied the markings to suit all the variations of gear with the same size and type of meter, neither does any injustice arise where the register is proved to be correct. However, even in cases of this nature the number of revolutions of the meter do not vary with the register, and are not affected by pressure. So established has become the acceptation of the number of revolutions with the register, even though the amount per revolution be not regarded, that inspectors appear no longer entitled to presume that all will be correct in the future with existing procedure and present-day contrivances. There can be no official guarantee that meters will either measure or register correctly only at the least practicable conditions of use.

Tentative Suggestions.

To all intents and purposes, these compensating registering contrivances appear as reasonable and just to both buyer and seller of gas, though their reliability has to be proved in use.

The most obvious thing to my mind is that compensation for loss due to measuring gas at different pressures, by means of varying the register, must first be lawfully recognized.

It is important that inspectors of meters should be in a position to deal with such matters in a satisfactory manner. It is scarcely fair argument to condemn the outcome of procedure with no good and practicable alternative suggestion other than the abolition of regulation.

The immediate concern of inspectors of gas-meters should be, that they are not in a position to deal with these contrivances under present law so far as to recognize them as legal machines by stamping.

As far as at this early stage it may be possible to comprehend, it does appear quite practicable to deal with this new matter officially if only the conditions necessary to do so were lawfully recognized and made generally applicable. It appears as only necessary to ascertain the percentage error of registration under such conditions as existing standard gasholders will admit. The soundness test would no doubt be applied at the maximum pressure the machines were required to withstand, with probably more severity as regards the registering of small flows.

With a higher pressure available than existing standard gasholders will admit, the aneroids could be first ascertained as actuating properly at different degrees (to be specified) of pressure, by spinning round the registering device by hand, and comparing the result with the upshaft drum or index testing-dial and a table of amounts commensurate to standard pressure supplied for the purpose. The index could then be replaced on the meter and the upshaft register be proved in the usual manner, or at different rates and pressures such as were considered necessary to specify.

It might almost be a foregone conclusion that once these machines are permissible, it would be open to use them at all conditions of supply. To enable ordinary meters to be dealt with properly, facilities must exist.

However imperfect these suggestions may be, makers should have no difficulty in devising means for proving the correctness or incorrectness, as the case may be, of their own machines. As a matter of fact, such assurance has, to an extent, been already given. However, the question still remains with inspectors; and their responsibility is, to decide by their action what will be done in the matter.

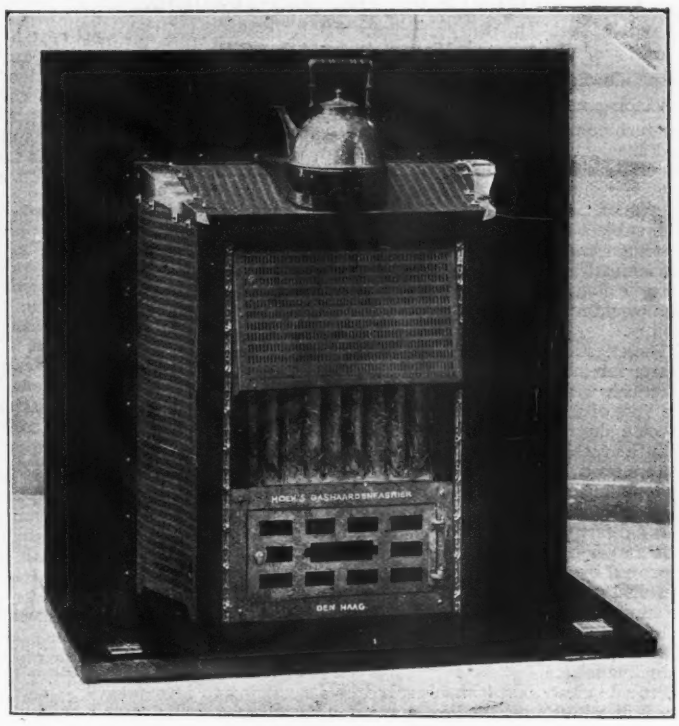
A New Standard of Light.—At a recent meeting of the Royal Society, Mr. W. A. Harwood and Dr. J. E. Petavel submitted the results of some experimental work they have carried out on a new standard of light. The source of light consists of a strip of platinum heated by an electric current. The thermopiles measure the radiation passing through a plate of black fluorspar and a water-trough. The thermopiles are connected in opposition. As the current through the strip is increased, the intensity of the luminous radiation increases more rapidly than that of the radiation of longer wave-length. Therefore, for a given thickness of the absorbing media and distance of the thermopiles, there will be one definite temperature at which the reading of a galvanometer in the thermopile circuit will be zero. A long series of experiments showed that the light could be kept constant within $\pm$ 0·5 per cent. when a constant temperature was maintainnd by the above criterion.

HOEK'S GAS-FIRES.

An Invention from Holland.

HARD by the Gas Demonstration Pavilion of the Gaslight and Coke Company at the Smoke Abatement Exhibition, there is a stand on which are disposed a number of striking gas-fires—striking from the three points of view of the novelty of the casing, the general construction, and the heat that is diffused. There are several styles of outer casings to this form of fire, which is known as Hoek's gas-hearth; and it comes from The Hague. The outer casings are picturesque—the plates of which they are composed being covered by oblong perforations, with strong framework, and brass mountings. The body part of the fire is made of chambers within which air circulates, and is dispersed through the openings in the outer casing. Needless to say, there is a large volume of convected heat obtained in this way; and, as a matter of fact, the inventor claims that no less than 95 per cent. of the calorific value of the gas consumed is supplied as effective heat into the room in which the fire is used—only 5 per cent. being utilized for flue purposes. The ventilating capacity of the fire is another point placed to its credit. A further unique feature of the fire is claimed to be the burners. These are stated to be made of a composition of iron and steel. They are vertical tubular burners (each consuming about 7½ cubic feet of gas per hour), and at their visible parts they are perforated, and from the perforations gas-jets play. Between the burners are placed shredded asbestos threads—the incandescence of which enhances the appearance and life of the fire, but it is not claimed that this does anything to improve the heating value of the stoves.

The fires are made in two sizes—five-burner and seven-burner ones; and each burner is controlled by its own tap, within a swing-door just below the active part of the fire. It will thus be seen that from one to the maximum number of burners can be used, just as desired, according to the temperature of the room. There is no smell from the fire. Some of the fires are also fitted with a top stand for the boiling of kettles. The fires, we were informed, have been under test continuously for three months without any difficulty. The five-burner stove is said to be equal to the heating of a room of 4000 cubic feet capacity, and the seven-burner one to heating one of 7000 cubic feet capacity.



Hoek's Hearth "Jeannette."

"VITREOSIL" ART-METAL GAS-RADIATORS.

A Novel and Highly Efficient Invention.

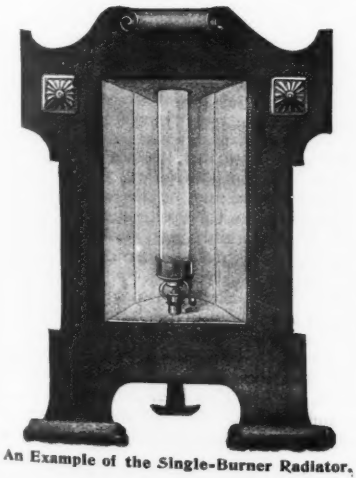
ON the stand of the Thermal Syndicate, Limited, at the Smoke Abatement Exhibition at the Royal Agricultural Hall, is a display of a variety of pure fused silica (quartz), which attracts considerable attention, and the qualities of which give one the impression that there is a large future for it for purposes in which high temperatures are employed. The material is known as "Vitreosil," and is the product of an invention jointly of Dr. J. F. Bottomley and Sir Richard Paget, Bart. The great value of the material for heating apparatus is readily seen by the statement that it has practically no co-efficient of expansion; and, on this account, it is able to withstand the extreme changes of temperature without cracking. So much is this the case that small articles can be heated to redness and plunged into cold water without suffering any damage. It is highly refractory, and does not soften under temperatures less than about 1400° C.

Messrs. Hands and Co. have taken advantage of the material in producing a series of gas-radiators that are distinctly novel, and in artistic appearance the rivals of the electric radiator, but in heating efficiency and economy transcending them to such a degree that there is really no comparison.

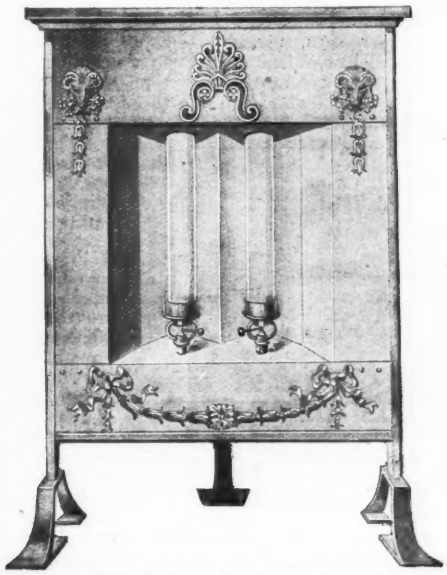
The "Vitreosil" gas-radiators are made of hand-beaten copper work (two samples of which are illustrated), and are arranged in sizes varying from one to four burners. The burner used is an ordinary atmospheric one; and the flame plays on to a spiral cone coil made of "Vitreosil." This cone is enclosed in an outer cylinder made of the same material; the coil finishing about half way up. Another cone, also made of "Vitreosil," but of a closer run and a larger diameter than the bottom one, is inserted in the top of the cylinder in an inverted position. Across the top of the radiator, a perforated fire-brick is placed. The radiators (which are portable) are made with or without flues, and need only be connected by means of flexible tubing.

The action of the radiator is as follows: The gas burns with a non-luminous flame, which comes into contact with the "Vitreosil" coil, and gets red hot very quickly. The top coil then comes into play, and acts as an economizer, taking up a large proportion of the surplus heat, which is radiated from the top part of the cylinder. One of the features of "Vitreosil" is that it is highly transparent to heat. Consequently, the heat being taken up by the spirals forces its way through the outer cylinder. By this means Messrs. Hands claim that an exceptionally large proportion of the heat is given out into the room in the form of radiant heat. The consumption of the radiator is very small—6 cubic feet per tube per hour. It is also claimed that there are practically no objectionable fumes given off from the radiator.

The radiators are being exhibited on the Thermal Syndicate stand at the exhibition; but it is understood that those on view are only tentative styles and constructions, and that the constructional improvements that are being effected will greatly enhance both appearance and value, though the principles will remain the same.



An Example of the Single-Burner Radiator.



A Two-Burner Radiator, with Adam Decoration.

THE PROSPECTS OF THE GAS-TURBINE.

By Alwyne Meade, Assoc.M.Inst.C.E.

The following article has not been written with the intention of advancing new theories and suggestions for the solution of the gas-turbine problem, but rather is it designed to convey, as clearly and succinctly as possible, some idea of the various inventions which have from time to time been experimented with, and to trace out the evolution of the turbine up to the appliances of the present day which are capable of doing a certain amount of useful work. The subject must necessarily be one of considerable interest to gas engineers of all grades; for the introduction of an efficient and economical rotary gas-engine would add untold stimulus to the already flourishing gas industry and exasperate electrical rivals, who would foresee an early doom for their somewhat capricious motors.

The question, however, is not one to be approached with a light heart; for innumerable are the difficulties, both theoretical and practical, which await the would-be inventor. Problems which are easy of solution when dealing with the reciprocating gas-engine become almost insurmountable when encountered in connection with the turbine. However, we already have continuous steam-motors brought to perfection, many of which are now to be found in up-to-date gas-works; and possibly these may, at no very distant date, be replaced by engines of the continuous combustion type. It is a difficult task to say much about the possibilities of the gas-turbine when it has been condemned by so many experts, and approved by so few; and the writer—who has no experience, but merely a general interest in the subject—will not commit himself by stating any opinions which he may have, but merely attempt to reiterate the experience of others, and collect information the greater part of which is only to be found in languages other than English.

Probably few topics have proved so fascinating to inventors, many of whom have jealously guarded their secrets, and have conducted their experiments behind closed doors; and, possibly, it is owing to this fact that the gas-turbine has made such slow progress. Mr. Dugald Clerk, however, expresses the opinion that engineers have made the mistake of thinking that the internal combustion turbine presents practically the same problem as the steam-turbine, and have not given sufficient attention to certain differences between them. Before describing the actual machines which have been used, it will be as well to consider the advantages which the gas-turbine would offer over the reciprocating engine; and these may be enumerated as follows: (1) Continuous motion in one direction; (2) easy control and regulation; (3) small amount of room occupied; (4) lightness of construction and simplicity; (5) accessibility; (6) smooth running and no vibration; (7) light foundations; (8) less first cost. These advantages in themselves are quite sufficient to compensate for any small loss of heat efficiency that might occur. But, unfortunately, there are also some important disadvantages which have to be reckoned with; and it is the disadvantages which have proved a stumbling block and rendered the dreams of the theorist uncertain. Further mention will subsequently be made of these.

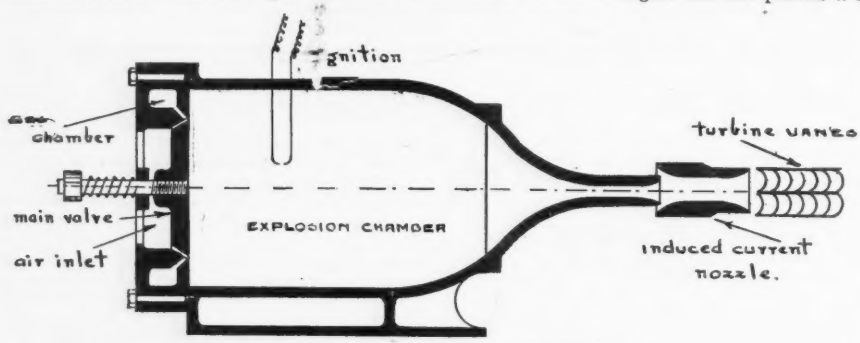


Fig. 1.—Ordinary Explosion Type of Gas-Turbine.

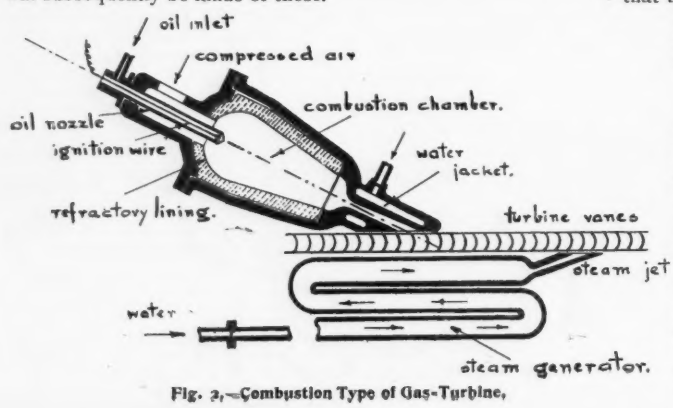


Fig. 2.—Combustion Type of Gas-Turbine.

Oddly enough, the first internal combustion engine invented was one which worked on the principle of the turbine; for in 1791 John Barber applied for a patent for a turbine operated by the explosion of a mixture of gas and air under pressure, the products of which impinged on the vanes of a paddle-wheel. Whether this invention reached a further stage than the filing of the patent is not known; and one can only draw conclusions as to its ultimate fate.

As regards the various plans which have been suggested for the design of gas-turbines, it is necessary to make a division into four groups—namely: (1) Hot-air turbines, (2) explosion turbines, (3) combustion turbines, and (4) mixed turbines, in which steam is used in addition to the products of combustion.

Hot-Air Turbines.

Of the first named, the Stolze hot-air turbine is the best known example. Air is compressed to some 25 lbs. per square inch by a special compressor. This air is then allowed to travel about the walls of a furnace, expands, and is led through a nozzle on to the blades of a turbine. Moreover, the compressor and turbine are attached to the same shaft. The disadvantage of such a turbine is that a separate air compressor is required; and therefore there is sure to be a fairly large percentage of negative work.

Explosion Turbines.

In the explosion type of turbine, there is no necessity for a compressor; and the method of working can be followed by referring to fig. 1. There is an explosion chamber, at the back of which is a valve held away from its seating by a spiral spring. When the valve is open, the gas and air are free to enter the explosion chamber, and are ignited by an electric spark. The pressure suddenly rises, shuts the inlet valve, and the gases pass through a special nozzle which is designed to reduce the temperature of the gases before they reach the wheel. After the emission of the gases, a sudden drop in pressure occurs. This causes the inlet valve to open, and the cycle is repeated. In this way about three explosions are made per second; and it is claimed that the apparatus will continue to run automatically when once it has been started. The arrangement is certainly ingenious; and a great advantage lies in the fact that there is no negative work, for the charge is exploded at a pressure just above atmospheric. But, practically, there are many difficulties to be surmounted, such as abnormally high temperature and low thermal efficiency; and the engine has not proved a success. This is one of the few gas-turbines designed to use ordinary town gas; and it is unfortunate that it has proved so unsatisfactory in practice; for, so far as the writer can judge, it would be difficult to apply the combustion principle to a turbine that relied on town gas for its motive power. It was found in practice that the efficiency of this type of turbine only reached a figure of from 3 to 4 per cent.

Combustion Turbines.

In certain types of reciprocating oil-engines—such as the Diesel oil-engine—the oil is not allowed to mix with air and form an explosive mixture such as we get in the cylinder of an ordinary gas-engine, but it is merely burnt, and combustion (not explosion) thus takes place. The air previously compressed in the cylinder is then expanded adiabatically; and in this manner the piston is driven forward. Exactly the same conditions have been applied in the case of turbines; and it is in this direction that the most encouraging and successful results have been obtained. The most general form of combustion turbine is really, as regards construction, very similar to the explosion type just described; but air is delivered to the combustion chamber from a compressor, and at the same time some form of liquid hydrocarbon is pumped into the chamber through an atomizer, and is burnt on coming into contact with a white hot platinum wire which is connected to an electric battery. The advantage this type of turbine has over the explosion type is that the process is continuous, and the pressure of the gas at the nozzle is practically uniform. In the other type, the pressure is continually varying as each explosion takes place; and this, of course, is most inadvisable.

Mixed-Gas Turbine.

We now come to what the writer prefers to call the mixed-gas turbine; and it is this device which has so far proved more satisfactory than any of the other types. Moreover, turbines working on this principle have been brought somewhere near perfection. Foremost among the class is the Armengaud-Lemale turbine, the design of which is shown in fig. 2. This turbine worked continuously for some years in the shops of the Société des Turbomoteurs at Saint Denis; and it is capable of giving a power varying from 400 to 800 H.P., according to the type of compressor used in conjunction with it. Air from the compressor enters at the back end of the chamber, mixes with the liquid fuel in the mixing-chamber, and ignition is obtained by means of a platinum wire which is attached to the end of the oil-nozzle. Combustion then takes place in the larger chamber,

and, moreover, it takes place continuously at constant pressure, and the products are discharged through the diverging nozzle upon the vanes of the turbine wheel.

Surrounding the nozzle is a water-jacket; and on the opposite side of the wheel is arranged a special steam generator, composed of a pipe bent round in serpentine manner and continually increasing in diameter. The water leaving the jacket round the nozzle is led into the coil of pipe, which is placed so that it encounters the full force of the exhaust gases leaving the turbine. The water is thus converted into steam; and this is discharged through the secondary nozzle on to the vanes. Thus the steam performs the double duty of extracting heat from the wheel, and of helping, to a small extent, in the propulsion. The inventors claim that in this way it is possible to reduce the temperature of the wheel to practical limits, provided the temperature of the exhaust gases is sufficiently high to generate the requisite amount of steam. The compressor used in conjunction with this turbine is of the Rateau rotary type.

From the point of view of ingenuity alone, probably there is no turbine to compare with that invented by Gadda, which differs from those already described in that it employs two complete and independent cycles. The turbine is deserving of description here, not on account of any exceptionally favourable results which may have been derived from it, but because it gives an indication of the fervent way in which inventors have attempted to tackle the gas-turbine problem, and of the numerous, and mostly useless, principles and devices that were applied to its solution. A diagrammatic sketch showing the arrangement of the turbine is given in fig. 3. There are three pumps, the first of which is used to compress the gas, which is stored in the reservoir adjoining the pump; the second is used to compress the air, which is also stored in a similar reservoir; and the third pump is for compressing the fluid (air) which is to perform the secondary cycle. The compressed air and gas travel along separate pipes to the explosion chamber, and here combustion or explosion takes place under constant volume; and the products are allowed to expand through the turbine.

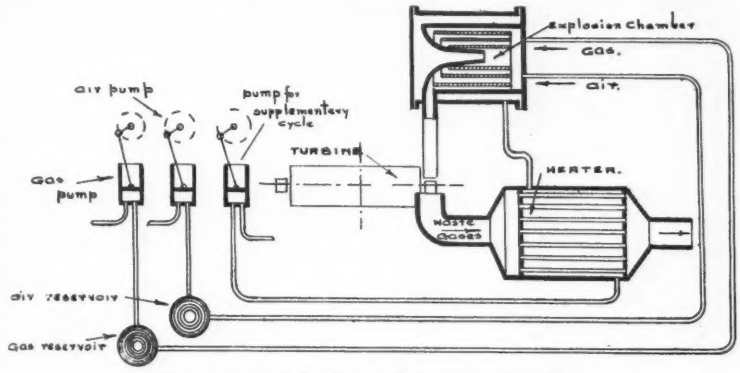


Fig. 3.—Gadda's Turbine, with Supplementary Cycle.

Within the combustion chamber, a substance (shown shaded) absorbs part of the heat of combustion. When the gases have passed through the turbine, they are led through the heater, and help to heat up the fluid which has been compressed by the third pump. The fluid then passes around the combustion chamber, enters it by the nozzle, and absorbs the heat from the substance already referred to. It is then allowed to expand through the turbine. Thus the two cycles succeed one another, and the turbine is alternately driven by the combustion products from the air and gas and by the fluid which is expanded by means of the heat extracted from the combustion products. The secondary cycle, in addition to aiding in the propulsion, also helps to reduce the high temperature in the turbine chamber caused by the explosion cycle. The change from one cycle to the other is arranged for automatically by making use of the reduction of pressure which follows the expansion of the gases.

The whole arrangement is, of course, somewhat complicated; and the writer has been unable to obtain any information which would throw light on its behaviour in practice. However, its utility as a commercial article would certainly be nullified owing to the need for the three reciprocating pumps; for it is of little advantage to employ a turbine when a pump has to be used which works on the principle that the turbine has been designed to abolish.

Practical Difficulties.

Having described some of the best known ideas which have been brought forward for the solution of the gas-turbine problem, it now remains to point out the defects which have up to the present prevented these ideas being carried into regular everyday use. Everyone knows, of course, that gas-turbines can be made to go round. But more than this is necessary; and if the turbine is to be a success, it must be capable of reaching an efficiency very nearly as great as that of the present-day reciprocating engines. The thermal efficiency of an ordinary gas-engine usually reaches a figure somewhere between 30 and 35 per cent., whereas it has been shown that, under the most satisfactory conditions, the thermal efficiency of a gas-turbine will only reach about 16 per cent. However, some slight improvement on this might possibly now be obtained; for in calculating the efficiency experts have usually assumed that it is not possible to get a rotary compressor with an efficiency of more than about 60 per cent., whereas there are now in existence turbo-compressors—such as the Rateau—for which an efficiency of about 75 per cent. is claimed.

Perhaps the greatest difficulty in connection with the practical working of the gas-turbine is the extremely high temperature of the gases after combustion; and though many devices have been employed to dissipate the heat, and to convert it into useful work, no really effective way of bringing about the desired temperature drop seems to have been evolved. Suppose we consider, for the sake of illustration, that the turbine is to work on the well-known Carnot cycle. Then we get

$$E = \frac{T_2 - T_1}{T_2}$$

Thus it is seen the efficiency depends on the difference between the mean temperature of admission and the mean temperature at which heat is extracted from the gas; and, theoretically, these two temperatures should, respectively, be as high and as low as possible.

The temperature of admission, however, is not nearly so important as the temperature of extraction; and for effective working this lower temperature (t_1) must be reduced as much as possible. The method of obtaining temperature drop which is employed in turbines—both steam and gas—is that of passing the hot fluid through a divergent nozzle of the De Laval type, in which the heat is converted into kinetic energy. In this way, it is possible to reduce the temperature from about 1800° C. in the combustion chamber to 750° C. at the outlet of the nozzle. The temperature in the combustion chamber—although exceedingly high—seems to have been successfully dealt with by employing a refractory lining, such as carborundum, and a water-jacket. It is the temperature of the gases impinging on the vanes which causes the injury; and no turbine blades can be expected to stand this continually for any great length of time. Various devices have been used to overcome this; and in the Lemale turbine, in addition to the jet of low-pressure steam there is a water-cooling arrangement which provides for the constant circulation of water through the blades, which are made hollow for the purpose. All these refinements, however, only tend to lessen the practical value of the turbine, and give it but little chance of competing with the reciprocating engine, which is comparatively simple in its construction. The proposal for cooling with a steam-jet is not to be advocated, on account of the fact that the vanes are passing alternately through hot and cold zones.

A second and important difficulty is to be found in the nozzles themselves; for, up to the present, little is known of the action of hot gases in diverging nozzles, and the probabilities are that the losses due to conduction, radiation, and friction would be great. It has been found, however, that hot air causes much less friction in nozzles than does wet steam; and so in this direction the gas-turbine should have an advantage over the steam type. The regulation of the turbine would, of course, be exceedingly simple, and would be effected by having a number of nozzles, and using either all or only some of them. This, again, introduces another drawback; for the greater the number of nozzles, the greater will be the radiation losses.

As regards the future of gas-turbines, it is improbable that any great headway will be made with any type other than those working on the combustion principle, such as that of Lemale. This turbine, as before stated, necessitates the use of a compressor; and the auxiliary is really of greater importance than the turbine itself. If the turbine is to be efficient, then the compressor must necessarily be efficient; for it must be remembered that the compressor is driven direct off the turbine shaft. The higher the efficiency of the compressor, the less the proportion of negative work will be. Thus, a necessary preliminary to the making of a workable turbine is the production of an effective compressor which will give an efficiency of about 90 per cent. At present, no such compressor exists. Consequently, the would-be gas-turbine inventor finds his path of progress beset with obstacles at the very outset. Even should an efficient compressor be produced, and a practical turbine evolved, the user will have in all probability to be satisfied with a low thermal efficiency. This disadvantage would, however, to a great extent be neutralized by the many advantages which the turbine would offer. Put in plain language, it simply means that the consumer who now employs a reciprocating engine would be obliged to use more gas than he does at present in order to obtain a given amount of work.

In conclusion, the writer desires to point out that he has purposely avoided discussing the gas-turbine from the point of view of thermo-dynamics. The article is not intended for the enlightenment of students of this science, but has merely been written for the purpose of giving gas engineers some general idea of the possibilities of an invention which would more or less revolutionize the industry to which they belong.

THE ILKESTON GASHOLDER.

By Professor F. K. Th. van Iterson, of Delft.

The drawing of the Ilkeston gasholder given by Mr. J. Ferguson Bell in the issue of the "Journal" of Feb. 6, p. 356, gave me the opportunity of calculating the stresses existing in that structure when exposed to a strong wind and charged with an asymmetrical snow-load according to the German standard specifications—viz., a wind pressure of 41 lbs. per square foot, and a snow-load on the lee half of the crown of 8·2 lbs. per square foot.

The stresses in the gasholder may be ascribed to two kinds of loads, which can be dealt with separately: (*a*) Those produced by the tilting moment due to wind pressure and asymmetrical snow-load on the lifts; and (*b*) those which result from immediate wind pressure on the parts of the holder that are next to the top edge of the tank. I will begin with the calculation of the last, as only this can furnish an explanation of the disaster which occurred at Ilkeston.

When a cylindrical surface is placed in a current of air, it is usually assumed that only the side exposed to the wind is loaded, and that the normal pressure, according to Newton's law, decreases with $\sin^2 \alpha$; α being the angle between the part of the surface considered and the direction of the wind. This leads to a distribution of forces, as indicated in fig. 1. But on the leeside of each

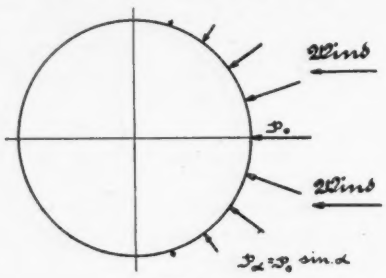


Fig. 1.

obstacle placed in a stream of air arises a depression; and therefore a better assumption is that there is a suction at this side of the holder, which equals the pressure at the wind-side (fig. 2).

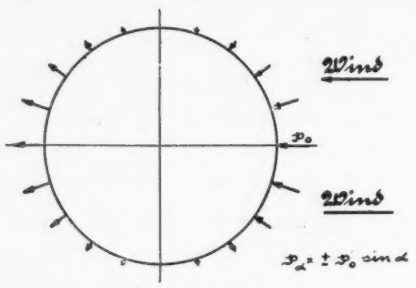


Fig. 2.

Both assumptions, however, are wrong. Fig. 3 gives the distribution of wind pressure on a cylindrical surface, as experimentally determined in the aerodynamical laboratory at Delft.

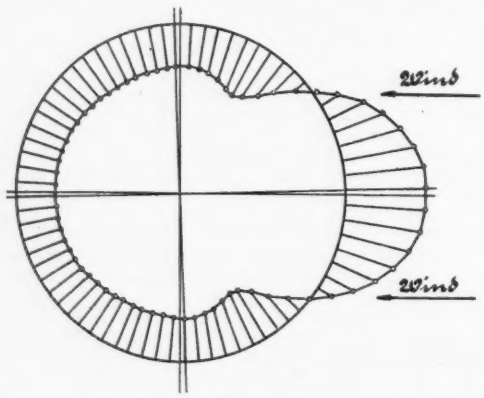


Fig. 3.

Pressures are drawn at the outside of the circle, and suctions at the inside of it. The strong pressure acting in the middle of the side exposed to the wind, and the suction on three-quarters of the surface, must cause a bending moment in the edge of the tank. To calculate it, we must make an assumption as to which part of the total wind pressure shown in fig. 4 is taken up by the stiffened edge of the tank. The upper parts of the bell inflated with gas are deformed to a certain degree, and can then withstand the wind pressure for themselves. [This will be explained later.] It is the same with the walls of the tank stiffened up by the internal pressure caused by the water. Only the parts of the structure which the stiff tank-edge prevents from deforming, bring the whole load of the wind to that horizontal girder. The assumption that half the load of the wind pressure on the second lift and a quarter of the load on the tank are taken up by the tank-edge, is not exaggerated. Several considerations will show that the charge in question is even more.

The total load on a cylindrical surface is only 0·58 part of the wind pressure on a plane surface of the same projection. This has been proved by several experiments. Hence, the total load on the tank-edge as indicated in fig. 4 will only be 21·3 tons. We

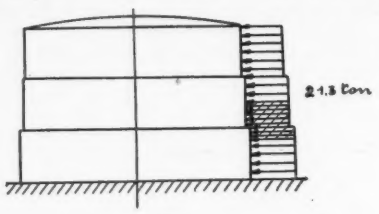


Fig. 4.

suppose the load to be distributed on the twenty guide-rollers, each roller taking up the wind pressure in its vicinity. This leads to the radial forces given in fig. 5.

The plates of the tank only resist shearing stresses acting in the directions of the plates. The distribution of these shearing stresses is well known. The shearing stress in each point of the section is equal to the area of section beyond that point, multiplied by the distance of its centre of gravity from the neutral axis.* This enables us to calculate the tangential forces which we suppose to be also concentrated in the spots where the rollers are attached to the girder (see fig. 5). That we take the shearing stresses concentrated, instead of distributed on the surface, makes a very small difference in the results. The bending moments in the ring

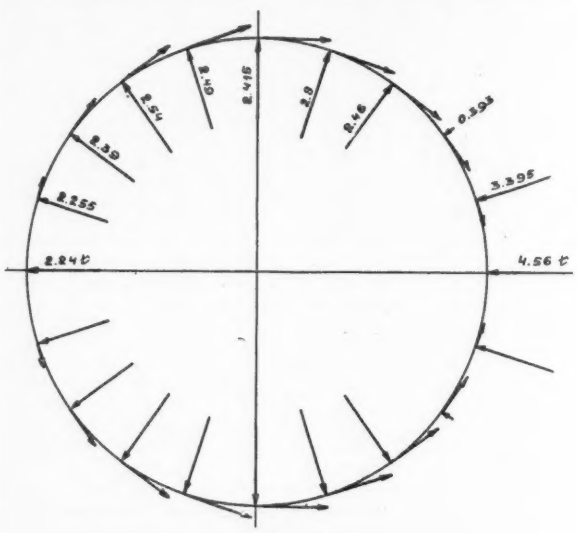


Fig. 5.

which are held in equilibrium by the tangential and the radial forces can now be calculated by a semi-graphical, semi-analytical method.† The resulting bending moments in each section of the ring are shown in fig. 6. The maximum momentum exists at the point to which the wind is blowing, and amounts to 1866 tons × inches. The moment of resistance of the section of the girder depends on which part of the vertical wall we consider as belonging to the section. In figs. 7 and 8 two sections are chosen; and the moments of resistance are indicated. By dividing the bending moment by the moment of resistance, we get the stresses. Hence assuming a wind-pressure of 41 lbs. per square foot, the stresses were 16·2 tons per square inch, or 18 tons per square inch. The edge of the tank was too weak to resist a heavy gale.

On the day of Jan. 8, there was a strong wind blowing just to the point where the fracture occurred; but this wind was not half so strong as that taken in the calculation. A heavy gale only blew in the evening and night following the accident. Still, I think it is possible that the bursting of the tank was a consequence of the weakness of its edge.

With members in tension, the ultimate strength of the material must be taken into account for the strength of the structure. In the case of the edge of the tank, the maximum stress in the girder is the compression at the outer portion. Not the ultimate strength,

* Perry's, "Applied Mechanics," 1901, p. 461. † *Ibid.*, p. 483.

but the yield-point of the parts under compression, is responsible for the breakdown of a structure. Long before the ultimate strength of the material is reached, the girder crumples at the edge in the way which can be seen on the left of the top of the photograph on p. 144 of the "JOURNAL" for Jan. 16.

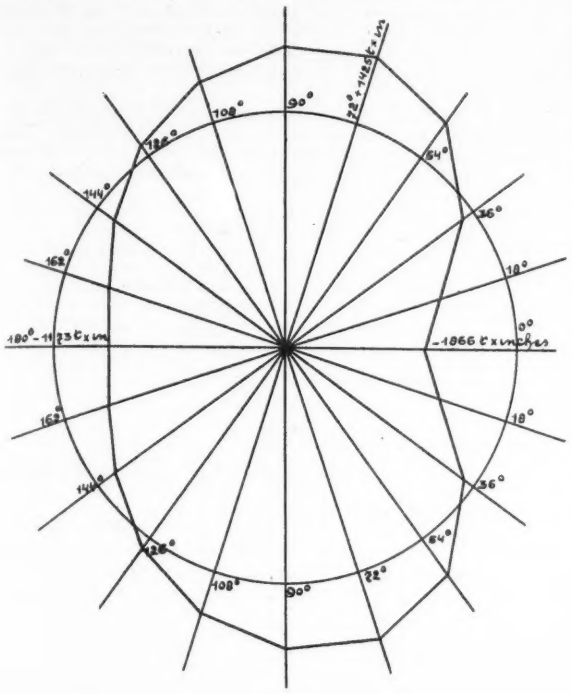


Fig. 6.

Most breakdowns of modern steel structures are caused by an insufficient factor of safety—not in regard to the ultimate strength of the steel, but to the load which would give excessive deflection of the compressed members. We must bear in mind that there always remain stresses in rolled bars, in consequence of the process of manufacture. In the angle-irons remain stresses, not far from the yield-point, caused by the cold bending. These stresses, combined with the local ones brought into the girder by the attachment of the rollers, by joints, &c., make it desirable to be a good deal on the safe side. A cross section shown in fig. 9 would be necessary for a wind pressure of 41 lbs. per square foot.

The disaster which occurred at Ilkeston may not be prejudicial to the increasing use of spiral-guided gasholders, as it cannot be imputed to a fault of the system. In fact, spiral-guided holders are safer in strong gales than those with guide-framings. This is demonstrated by practice, and can be proved by theory. The calculation for spiral-guided holders is less uncertain than that for the other ones. A brief exposition of the forces acting on the different members of the structure will show this. Fig. 10 gives the forces acting on the bell and second lift, which tend to tilt the floating part. The vertical components of the roller pressures can be no other than those indicated in the figure. As the guide-rails are inclined at 45°, the horizontal components are equal to the vertical ones. Thus the tangential pressures can be easily determined; and they are also pointed out in the figure. All the horizontal, tangentially-directed roller pressures give a resultant which will drive the floating bell to one side at right angles to the direction of the wind. This is made impossible by radial thrusts on the roller flanges. The radial pull and thrust on the rollers can be easily determined by graphical method.

The total shearing force resulting from wind pressure on the floating structure is taken up by radial roller pressures. When all these forces are taken into consideration, we can calculate the bending moments in the tank top girder, in the manner mentioned above. We then find that the maximum momentum occurs at an angle of 90° with the direction of the wind, but that it is much inferior to the bending moment calculated above, which was caused by the direct wind pressure on the parts of the structure near the tank-edge. In the section at 0°, where the last-mentioned moment reaches its maximum, the momentum resulting from the tilting forces is zero.

The most interesting part of the investigation of the forces acting in a gasholder is that the thin and flexible bell is able to resist the heaviest gales. Let R denote the radius of a circle, p the internal pressure on the unit of length (fig. 11), then it is well known that the

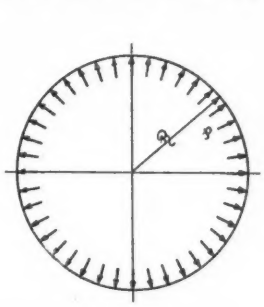


Fig. 11.

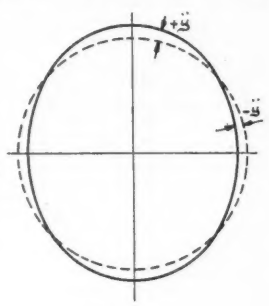


Fig. 12.

circumferential force acting in the ring is $p\,R$. It is less known that, when from any cause the ring is flattened in one part and protrudes at another, bending moments arise, counteracting the deformation, which can be easily expressed by figures. Love ["Treatise on the Theory of Elasticity"] has shown that these moments amount to $M = -pRy$.

A simple calculation shows that these moments are wholly sufficient to prevent any dangerous deflection of the walls of the unstiffened side of large holders. The deflection of small holders of the spiral-guided type must, however, be considerable, relatively as well as absolutely, before the straightening moment counteracts the wind-load. In fact, with small holders, several feet of deflection will occur; and this is the reason why at Ilkeston even a larger part of the total wind-load than is taken into account might be brought to the horizontal girder.

An important result of the theoretical investigations is that the larger spiral-guided holders are made, the more pronounced are their advantages over those with guide-framing.

CONCLUSION.

The inquest has not revealed the cause of the Ilkeston disaster. Though there is no direct proof, it is considered as the most probable explanation that the second lift jammed, and that this was followed by an unsealing of the cup and the falling down of the bell; and this impact coming on top of the stresses in the wall of the tank resulting from water pressure, caused the bursting of the tank.

It may be that this explanation is the right one; but I think it improbable because—

(1) Mr. Hallam, who at the time of the accident was near the holder, at the north side of it (to where the wind was blowing), states that he first heard a violent ripping noise, which he assumed to be due to the bursting of the tank. He then saw the holder begin to come down. He next observed

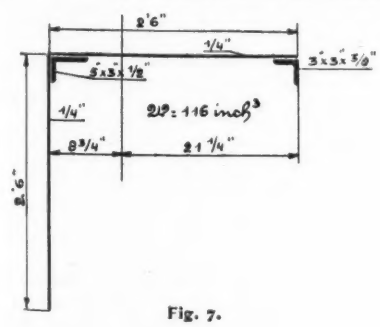


Fig. 7.

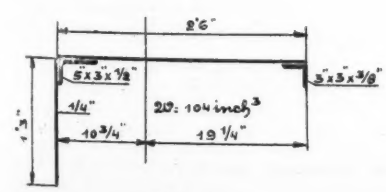


Fig. 8

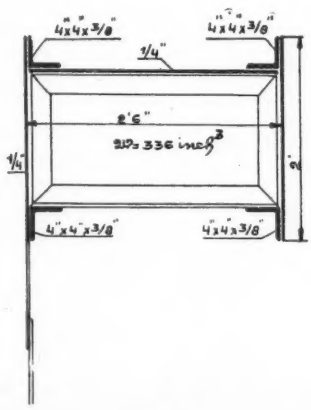


Fig. 9.

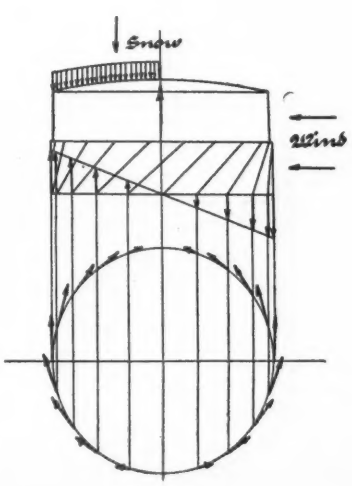


Fig. 10.

the flooding of Belfield Street, and lastly such a large and fierce flame that the heat drove him back up the street again.

(2) The bell, even when the cup is unsealed, cannot fall down as a falling weight, because the gas must be blown out through the narrow ring-shaped opening left between the inner and outer lifts. The impact, broken by the cushion of gas in the bell, could certainly not cause the bursting of the tank, which, as is shown by Mr. Bell (p. 355), was very strong to resist internal pressure.

(3) The gas which poured out vertically alongside the upper lift at 35 feet above the earth could not be ignited in the houses windward of the holder. The ignition can only be explained if the tank split to the bottom, and then the gas poured out at the south-east side at the level of the ground.

(4) It would be quite accidental that the tank should split precisely at the spot to which the wind was blowing—just where the maximum bending moment occurs, but without this heavy moment entering at all into the matter. This possibility seems too small to be accepted.

I am forced to believe that the accident at Ilkeston was caused by a weak part in the construction.

Of late years, accidents with gasholders have become less rare than formerly. This is a general remark, and does not concern any one firm. To prove this, I will mention some of the most serious accidents which have happened with modern holders.

Dec. 13, 1898.—The tank of a holder of 3½ million cubic feet capacity at New York (Consolidated Gas Company) burst. Diameter, 178 feet; depth, 42 feet. Until that date such a severe accident had never occurred. The wall of the tank was split vertically through the full plates. The water caused an enormous amount of damage. Some houses were demolished, and a large number of persons killed. The holder was being tested with air; but in other respects the accident resembles that at Ilkeston.

Dec. 17, 1905.—The inner wall and the crown of the free accessible space in the ring-shaped tank of a holder of 2·12 million cubic feet capacity at Amsterdam, were totally deformed at the first filling with water. If the structure had been strong enough to resist until it was brought into service, great mischief would have been caused.

Dec. 7, 1909.—The structure supporting the crown of the accessible inner space of the tank of the holder of 7·14 million cubic feet at the Grasbrook Gas-Works (Hamburg), broke down by deflection of the compressed members, and the gas was ignited. Twenty persons were killed, nine injured seriously, and forty-one slightly. A holder of 1·765 million cubic feet capacity near the one which broke down was also destroyed.

Aug. 4, 1911.—The stiffening ring at the top angle of the crown of the bell of the new holder at Vienna, of a capacity of 8·83 million cubic feet, broke down while the holder was being inflated with air. No persons were injured; twelve men who were on the crown were able to save their lives by clutching at the guide-framing. Great damage was done to the structure.

There seems to be some reason for a warning against excess of economy in modern structures—especially in the compressed members; and it is with this object in view that I have written the above article.

COMBINED GAS-COOKER AND COKE-STOVE.

Prize Competition by the Dutch Association of Gas Engineers.

We learn from the Secretary of the Dutch Association of Gas Engineers (Heer N. W. van Doesburgh) that arrangements have been made for a competition for a prize for a gas-cooking apparatus combined with a coke-stove for kitchen use. The nature of the appliance required is indicated in the following particulars.

The cooker must have at least four, and not more than six, points for cooking and stewing; at least one oven for frying and baking; and a special compartment for heating the plates. Stoves containing a hot-water tank with special burner will have the preference. One of the burners should be adapted for heating flat-irons, by preference with interior heating. The burners must be provided with an arrangement which allows of turning the gas low without impairing its combustion, which should be as complete as possible. The products of combustion of the gas-flames used for the frying and baking oven must have a constant outlet through the chimney; those of the other burners also, when the cooking and stewing points are closed.

The coke-fire must keep the temperature of a kitchen of about 1600 cubic feet capacity at 61° Fahr. during the severest cold of winter. The products of combustion must be conducted into the same chimney as those by means of which the gas products escape. The coke-stove should be lighted by means of a gas-flame. No kindlers, peat, wood, shavings, or any other material, are to be used to assist in making the fire.

The gas-cooker and coke-stove must be constructed in such a way that when the latter is burning its heat can replace that of the gas-flames partly or entirely during the operations of cooking, frying, and baking. The capacity of the cooker must be sufficient for a family of six persons. It must be of compact construction, and of simple but solid make; and economical consumption of the gas and coke is required. The retail price of the appliance should be within the reach of middle-class people.

The following are some conditions of the competition:—

1.—A specimen of the appliance must reach the Committee of the Association not later than Monday, the 9th of September next, at the International Gas Exhibition in the Paleis voor Volksvlyt, Amsterdam. [Particulars of the exhibition have already appeared in the "Journal."] It must bear some distinctive mark, but no indication of the designer's or manufacturer's name. The price of the cooker and stove, delivered free of charge in every place in Holland where there are gas-works, must be sent. When forwarding the apparatus, a sealed envelope, marked "Competition for a Combined Gas-Cooker and Coke-Stove," and containing the name and address of the designer or manufacturer, and indicating the distinctive mark, should be addressed to the Secretary, Heer N. W. van Doesburgh, C.I., Manager of the Municipal Gas and Electricity Works, Leiden, Holland.

2.—The Committee of the Association will examine the several appliances during the period of the exhibition, and award a first prize of 20 guineas in cash for the best. They will also award as many Certificates of Honour as they may judge necessary.

3.—The Committee will take care that all the appliances sent are shown during the exhibition (Sept. 14 to Oct. 6), and that the prizes awarded are mentioned. The competitors will be required to leave the appliances at the disposal of the Committee during that time; and they reserve the right to use them for demonstration purposes or allow them to be so used. At the close of the exhibition, the appliances will be at the disposal of the competitors, and subject to the regulations made by the Committee of the Exhibition.

A CENTRAL HYDRAULIC MAIN FOR THROUGH GAS-RETORTS.

With the view of avoiding the inconveniences which have been found to result from having two hydraulic mains on a setting of through retorts—one on either side—an arrangement with a single main has been devised, for which the Paris Gas Company have recently taken out letters patent.

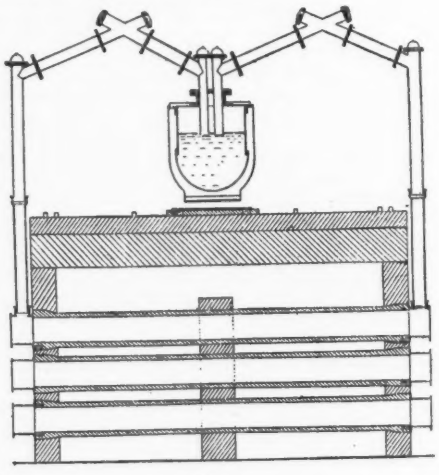


Fig. 1.

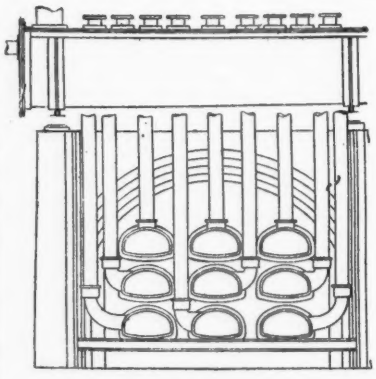


Fig. 2.

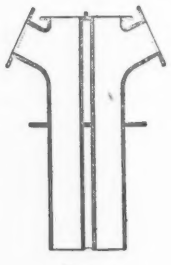
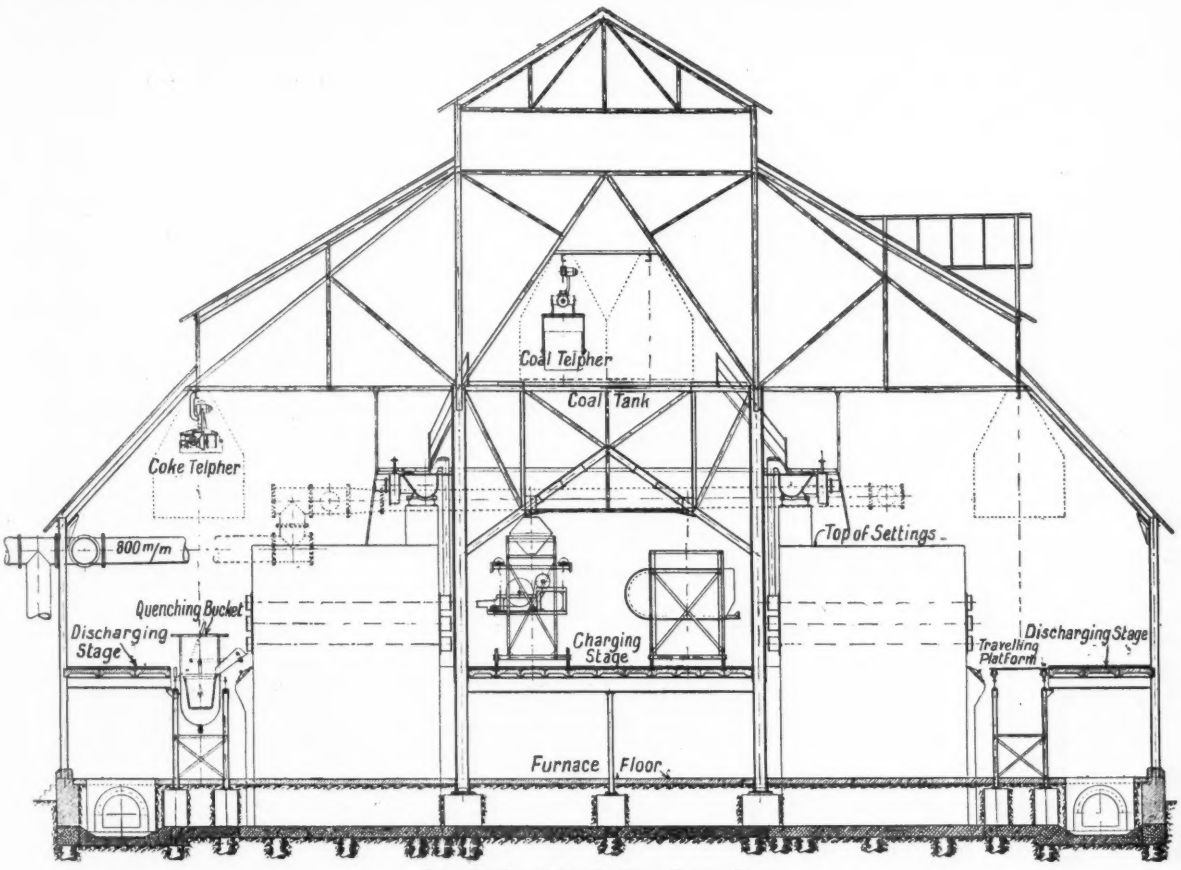


Fig. 3.

It will be noticed that the two ascension-pipes are connected to two separate dip-pipes ending in a central hydraulic main; and the advantage claimed for the arrangement is that the seal in each pipe is the same, and that the gas is simultaneously liberated at both ends of the retort. Figs. 1 and 2 show a setting of horizontal through retorts. The ascension-pipes are connected by the crossing pipes to two cast-iron dip-pipes made in one piece, or formed of two parallel pipes riveted together. The dip-pipe is shown on an enlarged scale in fig. 3. The crossing pipes are furnished with plugs, which can be removed to allow of cleaning. The invention is applicable not only to horizontal retorts, but to all plant for the distillation of coal—especially inclined retorts and Munich chambers.

SETTINGS OF TWENTY-FEET HORIZONTAL RETORTS, COMPARED WITH OTHER MODERN SYSTEMS.

Some information has previously been published about the settings of 20-feet horizontal retorts at the Stuttgart Gas-Works; and Dr. R. Nübling, the Manager of the works, has now given in a series of articles in the "Journal für Gasbeleuchtung" some further particulars of the plant, and a comparison of its working with that of other types of modern retort-settings. Although it might seem more to the point to allow the retorts to run first to the end of their working life, it is felt that the facts which are put forward in favour of other systems, as against the horizontal, ought no longer to remain unanswered. Moreover, the durability of this particular plant has been so far proved, in that after being in use 920 days, including 100 days for letting-down and bringing into action again, it seems likely the retorts will have a working life of 1150 to 1200 days. As reconstruction is only possible in summer, repairs will have to be undertaken after that period, regardless of the possibility of the plant lasting even longer. Figures for actual results can now be given in place of those previously published, which were more or less approximations. The construction of the house and the arrangement of the retorts are shown in the illustration.



Cross Section of the Stuttgart Retort-House.

THE SETTING OF 20 FEET (6 METRE) HORIZONTAL RETORTS.

One half of the present plant of thirty-two settings has been in use about 2½ years. The setting is 21·3 feet high up to the top of the arch, 10·5 feet broad, and nearly 20 feet deep, the mouth of the producer furnace protruding 2 feet in front. It has only one producer and pipe for taking off the gas on one side only. The retorts are elliptical, and 15·7 by 23·6 inches in cross section. This form of retort has been found more durable and easier to discharge in comparison with two trial settings fitted with Ω-shaped retorts. A step grate was chosen, and it has proved to be excellent. The slight sprinkling of the grate dispenses with the use of an evaporator. The hydraulic mains are placed 6·5 feet above the top edge of the furnace. This arrangement, together with the choice of ascension-pipes of suitable diameter, has had the good result of complete absence of stoppages of the latter.

The furnaces work with a positive pressure of 0·079 to 0·118 inch under the arch, and a suction of 0·157 to 0·236 inch in the last flue gas passage before the chimney damper. The supervision of the working, which is very simple, is entrusted to a special foreman. The temperatures are tested weekly with a Wanner pyrometer, the accuracy of which is checked by the occasional use of Seger cones. The temperature in the combustion chamber is kept at from 2430° to 2460° Fahr., and may rise to 2550°; in the secondary air passages, it stands at about 1940°; and in the retorts at 1920° to 2070°; while the waste gases are at about 1990°, falling to 910° under the ash-pan, and 840° in the main chimney flue. The spent gases contain 18 to 19 per cent. of carbon dioxide. One or two small bucketsful of tar are run off every two or three weeks from the Drory tar-overflows at every section of the hydraulic main, as a precaution against the collection of thick tar which, however, up to the present time has been absent. At first, water was run through the ascension-pipes with the object of preventing stoppages; but this has proved to be quite unnecessary, and indeed to cause some trouble. As a precaution, however, the stokers pass an auger through the pipes once in three weeks. Two men are occupied for six days in winter and three days in summer lubricating the eccentric fastenings of the retorts lids. Scurfing is found to be necessary about once in twelve weeks. The retort is kept open about 16 hours in all, for two to three hours of which a blast of air is used to facilitate the chipping-off of the carbon. The retorts are charged every eight or nine hours. The weight of charge per retort averages 11·5 cwt.; being somewhat lighter in the side retorts and heavier in the middle retorts. The men employed for each bench of eight settings are: One each for the charging and discharging machines, and one man on each side for opening and closing the lids. Two more men are employed for working the quenching apparatus, electrical conveyors, and for helping with the charging of the producers, &c. The latter are attended to every three hours—*i.e.*, once in six hours they are fed from the retorts, and at the intermediate times they each receive a basketful of small coke; the mouth of the producer being filled up each time with a few shovelsful of damp breeze. Formerly when only large coke was used, the producers were clinkered every eight days; but now that 15 per cent. of small coke (up to ¾-inch diameter) has been found practicable, clinkering has to be done every four days. Owing to the heavy charging of the retorts, the coke is of dense structure, and in large lumps, and is thus specially suited for central heating of houses. Its quality is quite equal to that of the coke produced by vertical and chamber settings. Its hardness gives it the advantage that little is lost in storage. The system of quenching is so satisfactory, that the coke coming from the retort-house contains only 2·5 per cent. to 3·5 per cent. of free moisture.

As above mentioned, the furnaces have already been working 920 days, including 100 for letting-down and bringing into action again, and will at that rate easily last out 1150 to 1200 days. The working of the charging and discharging machines has proved in no way detrimental to the durability of the material of the retorts. In the course of last year, only four pipes and four retort-lids had to be replaced; and since the settings have been in action, only three mouthpieces in all. As regards the charging and discharging machines, the necessary repairs have consisted in the replacement of the heads of the discharging arms and of the belts of the charging machines as they were used up. In one year, only

four of the former and three of the latter had to be renewed. The wear and tear of the charging belts has been considerably reduced by the application of the author's invention of reinforcing the Balata belts with steel bands. For instance, one such belt dealt with 33,700 tons; while of the two now in use, one has so far loaded roughly 20,000, and the other 30,000 tons. The wear and tear on the electrical apparatus has been quite insignificant, and the motors have stood their work remarkably well; the incidental expenses incurred for all the electrical machinery in one year having been less than £10.

The actual results obtained with these settings are as follows: Taking the average for a whole year, the daily production of one setting of nine 20 feet retorts is 169,800 cubic feet, including the time occupied in scurfing, &c. The coal carbonized consisted of 30 per cent. Saar coal, 40 per cent. English, 20 per cent. Westphalian, and 10 per cent. of mixed coal which had been stored in the open for two years. The area of the retort-house inside for thirty-two settings is 255·9 by 114·8 = 29,377 square feet; but as the plant is of very ample dimensions, 6 feet could be saved if necessary in the width, thus reducing the inside area to 27,842 square feet. The ground area for four benches, each of eight settings, is 111·9 by 19·7 by 4 = 8818 square feet. Therefore, on the basis of the foregoing average production of 169,800 by 32 = 5,433,600 cubic feet, the make per square foot of retort-house ground area is 185 cubic feet, and per square foot of ground covered by the settings is 664 cubic feet. The addition of water-gas plant, which would admit of a mixed gas like that produced by vertical retorts being made, would show no advantage over these figures for the make per square foot of ground area.

With the above-mentioned kinds of coal, the make for the year averaged 11,080 cubic feet (at 60° Fahr. and 30 in.) per ton of coal carbonized. The net calorific value of the mixed gas, with 11 per cent. of water-gas, was 552 B.Th.U. per cubic foot at N.T.P. Making a deduction for the quantity of water gas added, the net calorific value of the pure coal gas works out at 580 B.Th.U. at N.T.P. These figures indicate a gross calorific value of 686 B.Th.U., and a calorific valuation figure for the gas made of 7,216,720 calories per ton of coal.

These figures, which represent results obtained from the species of coal mentioned above and in ordinary working, must be acknowledged as extremely good. The make of gas is 12 per cent. higher than that obtained formerly with the old semi-producer handworked settings. To get a gas of the quality of that obtained from vertical retorts by the use of steam, about 30 per cent. of water gas could be added to the above production. The coke produced was:

From Saar coal	. . . . .	13·14 cwt.	per ton of coal.
„ English (Durham)	. .	13·67 „	„ „
„ Westphalian	. . . .	13·20 „	„ „
„ Mixed	. . . . .	13·54 „	„ „

No special trial has been made of the consumption of fuel in the producer. Every week, however, the fuel consumption of one or other of the furnaces, while in ordinary working, has been observed. Last year, the average amount of coke consumed was thus found to be equal to 12·55 per cent. by weight of the coal carbonized. An exact test with cold dry coke, covering four periods of three days each, showed 12·27 per cent. Ordinarily, the producers are charged with hot coke, and 15 per cent. of cold broken coke is added. The fuel required (12 per cent. of the coal carbonized) works out at 0·22 cwt. per 1000 cubic feet of gas produced.

The labour required for each shift per bench comprises one mechanic for the charging and one for the discharging machine, and two men to work the lids—making together for three shifts with four men each, twelve men per bench for 1,358,400 cubic feet, or a make of 113,200 cubic feet per man per shift for working the retort-settings alone. Reckoning one man more per bench and shift for clinkering (who will also control the water inflow, prick through the step grate and remove the pan coke), the figure becomes reduced to 90,556 cubic feet per man per shift. If the gas were brought to the same quality as that from the verticals, by the addition of 30 per cent. of water gas, as already stated, the average production per man per shift would be raised to 111,300 or 139,100 cucic feet. It is an undeniable disadvantage that considerably more labour is required for horizontal than for vertical or chamber settings. This disadvantage is in this case, however, quite counteracted by the results, as will be shown later.

It may be mentioned that the gas before the washers contains about 15·3 grains of naphthalene per 100 cubic feet. The sale of retort carbon covers about half the cost of oil for washing.

The cost of building the retort-house with two parallel rows of eight horizontal settings (or 16 settings) capable of producing 2,716,800 cubic feet, was as follows:—

Retort-House.

	£	s.
Foundation of house	1,715	0
Ironwork, including windows, doors, staircases, quenching tank, conveyor, plumbing, &c.	5,684	0
Glazing doors and windows	180	0
Paving of floors, above and below	722	15
Masonry of walls	487	0
Roofing with brick tiles	232	15
	£9,021	10

Furnace Plant and Fittings.

	£	s.
Brick foundation (not reckoned for above), other brickwork, insulation, &c..	798	15
Settings fitted ready for work, 16 at £1004 10s.	16,072	0
Two chimneys, 115 ft. high, with fireclay lining up to 65 ft., maximum diameter 4 ft., and foundations for same	1,862	0
Complete system of pipes for gas and water, with valves complete	784	0
	£19,516	15

Coke and Coal Conveyors.

	£	s.
Coke—		
Two quenching tanks with electric motors	343	0
Four electric telpher carriers, with wires and rails .	803	10
Coal—		
One electric telpher carrier for 23·5 cwt. load . . .	318	10
Two sets of charging and discharging machines with overhead electric rails	2,450	0
	£3,915	0

Retort-house with furnaces and conveyors complete, £32,453 5s.

Comparisons from Various Points of View.

In comparing the various systems of modern settings—*i.e.*, of horizontal and vertical retorts, and large chambers—the most important points to notice are interest on capital outlay, amortization, wear and tear, wages, and cost of fuel. Other advantages and disadvantages are of little account. The relation of the heat obtained in the form of the gas to the cost of product must also be considered. In the following tables, typical examples of the different systems are compared from various points of view:—

Production per Square Foot Area of Floor Space of Retort-House and Furnaces.

[Note.—These volumes, being for comparison, are not reduced to English normal temperature and pressure.]

Description.	No. of Settings.	No. of Retorts.	Production per Day.	Production per Square Foot Area of Retort-House.	Production per Square Foot Area of Settings.	Remarks.
			Cubic Feet.	Cubic Feet.	Cubic Feet.	
Cologne, vertical, 13 feet retorts . . .	24	240	3,246,600	190	517	steam blown into retorts
Mariendorf, vertical, twelve 16 ft. 6 in. retorts in a bed .	14	168	2,522,000	199	526	„
Mariendorf, vertical, eighteen 16 ft. 6 in. retorts in a bed .	14	252	3,485,000	275	728	„
Munich, inclined chamber settings .	1	..	105,960	164	469	..
„	1	..	141,280	213	604	..
„	1	..	176,600	263	633	..
„	1	..	211,920	295	699	..
Horizontal retort settings described in previous part of article				176 (in previous part reduced to English N.T.P.)	591	..

A comparison may now be made of the cost of erecting these various plants, taking only the settings and retorts, without auxiliary apparatus, &c. To produce, for example, 5,175,000 cubic feet of gas, there are required:—

	Cost of One Setting. £ s.		Total. £
38 Vertical retort-settings, each with ten 13-feet retorts	1715 0	..	65,170
or 21 Vertical retort-settings, each with eighteen 16 ft. 6 in. retorts . . .	2450 0	..	51,450
or 29 Munich chamber settings 19 ft. 6 in. .	1960 0	..	56,840
or 24 „ „ 21 feet . .	2303 0	..	55,272
or 32 Horizontal retort-settings with 19 feet retorts	1004 10	..	32,144

The interest on capital is reckoned at 4 per cent., the amortization and wear and tear together at 12 per cent. for retort-settings, and 10 per cent. for chamber-settings. Taking 230 full working days, the production is about 1200 million cubic feet of gas per annum from each of the above plants.

Description.	Cost of Erection.	Amortization, Interest on Capital, Wear and Tear.	Amortization, Interest on Capital, and Wear and Tear per 100,000 Cubic Feet.
	£	£	s. d.
38 settings of ten vertical retorts . . .	65,170	10,427	17 4
21 „ eighteen „ . . .	51,450	8,232	13 10
29 Munich chamber settings 19 ft. 6 in. .	56,840	7,958	13 2
24 „ „ „ 21 feet . .	55,272	7,738	12 10
32 settings of 19 feet horizontal retorts .	32,144	5,143	8 6

In order, however, to bring the other gases to the same quality as the vertical-retort gas, 15 per cent. of water gas may be added to the gas from the chamber settings and at least 25 per cent. to

that from the horizontal retorts. This alters the above figures somewhat as follows:—

Description.	Cost of Erection.	Amortization, Interest on Capital, Wear and Tear.	Amortization, Interest on Capital, and Wear and Tear per 100,000 Cubic Feet.
	£	£	s. d.
38 settings of ten vertical retorts	65,170	10,427	17 4
21 ,, eighteen ,,	51,450	8,232	13 10
26 Munich chamber settings, 19 ft. 6 in.	49,960	6,994	
Water-gas plant, 700,000 c. ft. production per day	6,615	595	12 8
20 Munich chamber settings, 21 feet	46,060	6,448	
Water-gas plant, 700,000 c. ft. production per day	6,615	595	11 8
25 settings of 19 feet horizontal retorts	25,113	4,018	
Water-gas plant, 1,000,000 c. ft. production per day	7,350	661	7 8

Amortization and wear and tear of water-gas plants is reckoned at 5 per cent., and interest at 4 per cent., as before.

The estimation of the labour required in relation to the production of gas is always difficult, as it naturally entails much guesswork. The figures given are mostly those published from time to time in literature; but they have been modified, as far as possible, by actual figures given from the various gas-works. The work entailed in each case comprises charging and discharging operations, cleaning of ascension pipes, hydraulic mains and producers, and handling of fuel; but not the removal of the coke from the retort-house.

Description.	No. of Settings.	No. of Retorts.	Men per Day of 24 Hours.	Production per Day.	Production per Man.
				Cubic Feet.	Cubic Feet.
Cologne, 13 feet vertical retorts	24	240	22	3,246,600	147,600
Zürich, 13 feet vertical retorts	10	100	8⅓	1,448,100	170,400
Mariendorf, 16 ft. 6 in. vertical retorts	14	168	11	2,521,800	229,300
Mariendorf, 16 ft. 6 in. vertical retorts	14	252	14	3,485,000	248,900
Munich inclined chambers (Munich)	12	..	9	2,543,000	282,600
Munich inclined chambers (Hanau)	8	..	5	1,130,200	226,000
Munich inclined chambers (Rixdorf)	5	..	6	953,600	158,900
Munich inclined chambers (Leipzig)	8	..	11	1,695,400	154,100
20 feet horizontal retorts	8	72	15	1,358,400	90,600

To compare the cost in wages per 1,000,000 cubic feet of gas produced, a uniform production of (say) 2,587,500 cubic feet may be taken. For this there are required:—

	Cubic Feet.
With 18 settings each of ten vertical retorts, 11 men per day; giving a production per man of	235,200
With 10 settings each of eighteen vertical retorts, 10 men per day; giving a production per man of	258,700
With 12 Munich chamber settings, 10 men per day; giving a production per man of	258,700
With 16 settings each of nine horizontal retorts, 30 men per day; giving a production per man of	86,200
With 16 settings each of nine horizontal retorts, with addition of water gas	106,000

Reckoning a man's daily wages at 5s., the cost in wages per 1,000,000 cubic feet produced becomes:—

Settings of ten vertical retorts	21s. 0d.
,, ,, eighteen vertical retorts	19 0
Munich chamber settings	19 0
Horizontal retorts	58 0
,, with water gas	47 0

No results are so hard to judge from published figures as those for the quantity of fuel used in the producer. It is very seldom that ordinary working figures are obtainable; those from special experiments being generally given. The latter are liable to be misleading; the experiments being naturally conducted under the best possible conditions. The following table has been compiled from as large a number of results as possible. For vertical retort settings, the average of 32 figures given from 25 different gas-works between 1906 and 1911 has been taken. For chamber settings, only six figures were available from three different stations.

Returning to the original project for a make of 2,587,500 cubic feet of gas, the following figures are found for fuel:—

Description.	Coal Carbonized.	Value of Coke per 1,000,000 Cubic Feet Made, at 22s. per Ton.
	Per Cent.	£ s.
Settings of 12 vertical retorts	15·0	14 4
,, 18 ,, ,,	14·0	13 4
Munich chamber settings	14·5	13 14
Horizontals	12·5	11 16

It is practically impossible to gather data for comparison of coke production, as the results depend so largely on the amount of moisture the coke contains.

For the comparison of the calorific value in proportion to the make of gas, a considerable number of results are to hand. An average of these is shown in the following table:—

Description.	Make of Gas per Ton of Coal.	Gross Calorific Value in B.Th.U. per Cubic Foot.	Calorific Valuation Figure.
	Cubic Feet.		
Verticals	12,240	595	7,282,800
Large chambers	11,490	615	7,066,350
Horizontals	10,520	686	7,216,720

(Not reduced to English N.T.P.)

Conclusion.

In conclusion, a summary of the figures already given shows as cost in interest, amortization, wear and tear, wages, and fuel of making 1,000,000 cubic feet of gas:—

	£ s. d.
With settings of eighteen vertical retorts	22 10 0
,, ,, twelve ,,	25 16 0
,, Munich chamber settings	23 2 0
,, Horizontal retort settings	21 8 0

A few remarks in conclusion. In general results, there seems to be little to choose between the three types of retort-settings. The heating value of the gas and the value of bye-products are much the same for all; the main difference lying in the outlay of capital and amortization, and, to a certain extent, in wages and firing. The choice of one or other of these systems must necessarily depend on local conditions; and, at any rate, it is shown that the horizontal setting holds its own. A smaller town would naturally be inclined to cut down its capital outlay; and in these times of rapid progress, this is, perhaps, an important consideration in all cases, when all three systems may be supplanted by a better one at very short notice.

DESSAU VERTICAL RETORTS IN THE YEAR 1911.

By Dr. W. Bueb, Manager of the Dessau Vertical Retort Company, of Berlin.

The following is an abstract translation of an article on this subject which Dr. Bueb has contributed to the number of the "Journal für Gasbeleuchtung" for March 23.

Every technical man who visits the fine retort-house plant at Stuttgart will be pleased with it, and will not be surprised that Dr. R. Nübling, in his recent communication [*vide* p. 29], has been able to report that the results obtained have been satisfactory to the deviser. On the other hand, he holds views in regard to vertical retorts which do not always agree with the experiences of the author's Company; and hence some remarks thereon may be of interest.

Depreciation.

It is generally correct to write off amply in respect of depreciation. In comparing different systems of retort-settings, however, regard must be paid to the actual conditions. It does not make for lucidity to amalgamate amortization and annual maintenance charges. The allowance for amortization does not depend on the durability of the settings, for with thorough repairs these might have an almost unlimited life. It depends rather on the number of years within which the setting ages to such an extent that it might advantageously be replaced by a new installation. Producer gas-fired settings of horizontal retorts have been erected only since the seventies, and are still in use in many places, while the inclined settings which appeared at the end of the eighties have already had to be reconstructed in some cases. The author thinks that vertical retort-settings, which constitute a great advance on former settings, may be well allotted a working life of 25 years; and on this assumption the annual amortization would correspond to a little more than 3 per cent.

In regard to maintenance charges, there is not, in his opinion, the smallest reason for attributing greater durability to large chamber settings than to vertical or even horizontal retort-settings. It is well-known that a great number of large chamber settings of different systems have proved unsatisfactory in this respect, even in the short time in which they have been in existence, and fundamental changes in the heating and construction of the chambers have been necessary, in order to secure the durability essential for regular working. The actual conditions are very different with vertical retort-settings. Reports from a very large number of gas-works show that vertical retorts last well, and even longer than horizontal or inclined retorts. The oldest vertical retort-settings at Mariendorf have now been in use for 1600 days without any repair. Mr. Körting hopes that they will run for 2000 days. But where vertical retort-settings only are in use, one setting will on the average be used for not more than 200 days in the year. Hence if the retorts were only good for 1200 days, the installation would last six years before the lower portions of

the retorts would have to be renewed, or for ten years if the retorts were good for 2000 working days.

But where there are only a small number of vertical retort-settings which are kept in use throughout the year, the other settings appear in a favourable light. The maintenance charges with vertical retort-settings are favourably influenced by the following considerations: (1) The partition wall between the retorts needs very little fire-brick material. (2) There is no arch to the setting. (3) The arch above the producer is done away with, and, therefore, repairs to it have not to be considered. The producer and regenerator are placed in front of each setting where they can come to very little harm. (4) The equipment of the settings receives favourable treatment, because the retorts are charged two to three times less often than horizontal retorts, and no iron tools come in contact with the retort-lids, &c. (5) Drawing and charging machinery, which involves considerable maintenance, is entirely dispensed with. (6) Coke-conveying plant is used for many fewer hours in the day than with horizontal retorts, because of the large capacity of the settings, the long period of carbonization, and the high speed of operation—viz., 1 ton of coal, or the equivalent of coke, per minute. Hence considerable economy ensues.

Having regard to these facts and the economies actually established in different works, not more that 3·5 per cent. of the capital outlay need be reckoned for annual maintenance charges. Interest at 4 per cent., amortization at 3 per cent., and repairs at 3·5 per cent., make together 10·5 per cent. of the capital outlay. Or, conversely, if it is assumed, as is justified, that one-third of 1d. per 1000 cubic feet is saved in cost of repairs by the adoption of vertical retorts, this is equivalent to about £125, or 5 per cent. of the capital outlay for a setting of eighteen vertical retorts in use throughout the year.

Fuel Consumption and Make of Gas.

Great care is requisite in comparing fuel consumptions in different works and towns. In the first place, the fuel consumption differs very greatly for different descriptions of coal, and in the second place gas-works have great difficulty in establishing the quantity of coke actually consumed. Hence judgment formed from published results taken at random is not so likely to be correct as one based on the results of the working of vertical retort-settings and other types of settings alongside one another, where the conditions of work, coal, and coke are the same for all the types. The general view of men who have had extended experience with vertical retort-settings is that when the retorts are worked with steaming, a considerably greater number of heat units are obtained in the form of gas at a very much lower expenditure of fuel than by the use of inclined or horizontal retort-settings with independent water-gas plant. [See Dr. Leisse's paper, "Journal," Vol. CXV., p. 479.] The difference may best be recognized where there are (as in Berlin) under the same management one gas-works using only vertical retorts, another using only inclined retorts with water-gas plant, and a third using only horizontal retorts. Where such chances of exact comparison exist, there appears to be no doubt as to the considerable economical superiority of vertical retort-settings.

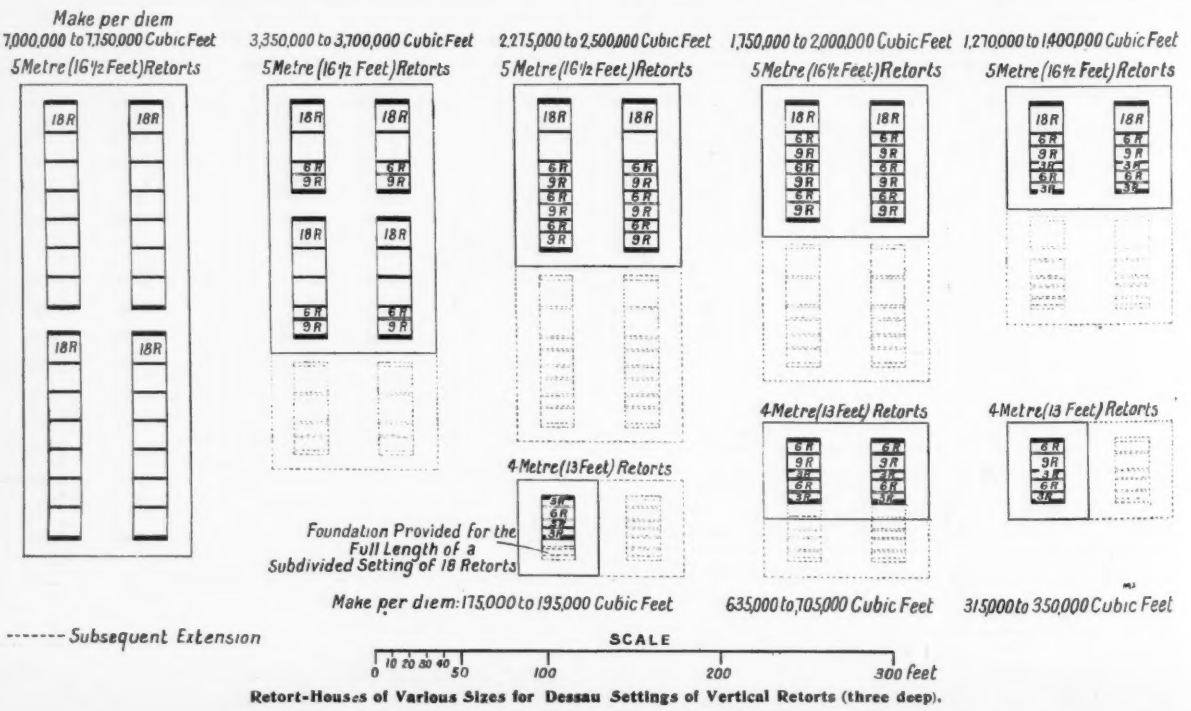
Labour.

A great advance in Dessau vertical retort-settings was effected when the arrangement of the retorts in three rows, one behind the other, was adopted, with the three retorts connected to make a single working unit. A repetition of such a radical improvement naturally could not have been expected last year, but there was a good deal of steady development. Exhaustive studies and investigations of the heating of the retorts and the most favourable distribution of the heat were made, with the result that it was found possible to enlarge somewhat the cross section of the retorts, and so increase the productive capacity of the setting. The settings of eighteen vertical retorts of the 1911 model have profited by the results of these investigations. Such a setting produces 245,000 cubic feet of gas from English coal, or 280,000 cubic feet from Silesian coal in 24 hours. This setting is a unit suitable for quite large works. In regard to labour, it is better to consider the number of workmen required to handle so much coal or coke in a given time than to state that so many workmen are required for a given number of settings per diem. For instance, the author has observed recently with large horizontal carbonizing chambers that four men could easily charge or discharge 11 tons of coal in 14 minutes, which is equivalent to about 4 cwt. per man per minute. With vertical retort-settings of the 1911 pattern, 1·7 tons are dealt with in from 1½ to 2 minutes, or (say) 8½ to 11½ cwt. per minute per man. This high return for the labour expended suggests that it is not advisable to diminish the number of workmen by enlarging the carbonizing vessels and dispensing with night work, but that retorts and night working should be maintained tor the sake of uniformity of the quality of the gas. Sound carbonizing chambers, of which vertical retorts are illustrative in a high degree, coupled with the certainty that gas is not forced into the furnace chamber, or furnace gases drawn into the coal gas, afford advantages which are not to be lightly given up.

The number of men actually required in practical working should also be accurately established. At the Mariendorf Gas-Works, where there are now twelve beds of eighteen retorts, and six more are under construction, the following results have been obtained. The settings with three rows of retorts are worked in about the same time as those with two rows. Consequently, 40 per cent. of labour is saved. Two shifts, each comprising two men, suffice for ten settings. The men work for five hours, and have three hours' rest. The actual time given to the service to the retorts is two to three hours per shift; the remainder being devoted to subsidiary work—such as charging the producers, cleaning the gas take-off pipes and the hydraulic mains, and controlling the steam supply. The clinkering of the producers and keeping the discharging machines clean are not included.

Retort-Houses and Size of Settings for Gas-Works of Different Capacity.

For large works clearly only large units will be adopted for the settings. For instance, if the retort-house is for a productive capacity of 7 million cubic feet per diem, which corresponds to No. 3 retort-house in Mariendorf, it will contain twenty-eight settings of eighteen retorts. With smaller installations, the large settings should be retained for a portion of the make corresponding approximately to the minimum summer production. These settings, which would be worked throughout the year, and would not be affected by the changes in consumption in the course of the year, should have the highest productive capacity. The rest of the settings should be of a size sufficiently small for them to follow without too great leaps the changes in gas consumption. With this idea, a diagram has been drawn up to show the arrangement for a number of retort-houses of different productive capacity. The disposition of the retorts in three rows from front to back of


Make per diem
7,000,000 to 7,150,000 Cubic Feet
5 Metre (16½ Feet) Retorts
3,350,000 to 3,700,000 Cubic Feet
5 Metre (16½ Feet) Retorts
2,275,000 to 2,500,000 Cubic Feet
5 Metre (16½ Feet) Retorts
1,150,000 to 2,000,000 Cubic Feet
5 Metre (16½ Feet) Retorts
1,270,000 to 1,400,000 Cubic Feet
5 Metre (16½ Feet) Retorts
4 Metre (13 Feet) Retorts
4 Metre (13 Feet) Retorts
4 Metre (13 Feet) Retorts
Foundation Provided for the Full Length of a Subdivided Setting of 18 Retorts
Make per diem: 175,000 to 195,000 Cubic Feet
635,000 to 705,000 Cubic Feet
315,000 to 350,000 Cubic Feet
------- Subsequent Extension
SCALE
0 10 20 30 40 50 100 200 300 feet

Retort-Houses of Various Sizes for Dessau Settings of Vertical Retorts (three deep).

the setting has been adhered to throughout, and a setting of eighteen retorts has been adopted as the standard, so that its great advantages should not be lost. But it has been subdivided, according to the size of the gas-works, into either two smaller ones—viz., one of six and one of nine retorts; or into three small ones, viz., one of three, one of six, and one of three retorts. The smallest unit then produces upwards of 35,000 cubic feet of gas per diem, or as much as a setting of four or five horizontal retorts. Such a unit is suitable for quite small gas-works. Settings of six vertical retorts have already been successfully used, and settings of three retorts are about to be tried. The question arises, what is the smallest make for which vertical retort-settings can be economically employed? It may be put at something under 35 million cubic feet per annum. Where coal and wages are dear, vertical retorts will be adopted earliest. The displacing of heavy manual labour will, however, often lead to the adoption of vertical retorts on social grounds before any definite financial advantage can be established.

In regard to cost of working, a particular case may be taken, based on the prices prevailing in, and experience gained at, Berlin. The labour required for horizontal retorts has been calculated from the actual conditions at several adjacent gas-works. For small gas-works, the vertical retort has the advantage that one man can perform all the necessary operations one after the other, and that two men are at no time required simultaneously. On the other hand, it is not desirable to leave the vertical retort-settings for any length of time without supervision. Hence three eight-hour shifts are adopted. But for a smaller gas-make than 87,500 cubic feet per diem, two men, working in twelve-hour shifts, could do all the work. The assumption that the summer consumption is half as great as that of the winter is based on the conditions in the smaller suburbs of Berlin, where the gas used in private dwellings far exceeds the consumption for business purposes. The large increase in the use of prepayment meters indicates that similar relations between the figures will shortly prevail in most German towns. It will be seen from the appended table that, in the conditions assumed, a considerable economy ensues from the use of vertical retorts. This economy amply suffices to cover the increased cost of the vertical-retort plant. It therefore would appear that there is no reason why a great number of small and medium-sized works should not take advantage of the convenience of vertical retort working.

Retort-House Working Charges for a Works with a Daily Output of 87,500 Cubic Feet in Summer and 175,000 Cubic Feet in Winter.

	For the Summer Make of 87,500 Cubic Feet per Diem.		For the Winter Make of 175,000 Cubic Feet per Diem.	
	Settings of Three Rows of Vertical Retorts.	Semi-Producer Settings of Horizontals.	Settings of Three Rows of Verticals.	Semi-Producer Settings of Horizontals.
Settings Required.	Two, one of three and one of six retorts, producing 94,500 to 105,000 cubic feet per diem.	One of eight and one of six retorts, producing upwards of 98,000 cubic feet per diem.	Three of three retorts and one of six, producing 175,000 cubic feet per diem.	Three of eight retorts, producing 175,000 cubic feet per diem.
Coal Transport from Store to Retort-House.	Mechanical Conveying is essential. Seven tons are conveyed in three hours. The coal is shifted into trolleys and taken to the coal breaker.	The coal is broken by hand and wheeled to the retort-house; 8·3 tons of coal require one man for half-a-day.	14 tons are conveyed in six hours.	16·8 tons require one man for one day.
Retort Service.	About ten minutes per shift is required for the service of the retorts. The stoker therefore can attend to the conveying of the coal and the clinkering, clearing of the gas outlet pipes, and control of the settings.	Generally one man working twelve-hour shift is reckoned for each semi-producer setting. Hence four men are required per diem. The same number would be required if eight-hour shifts were worked. The stoker attends to the clinkering and the clearing of the ascension pipes.	About 20 minutes per shift.	On the foregoing basis, six men are required.
Coke Transport.	In front of the settings runs a De Brouwer trough which carries the coke into a bunker outside the retort-house. This bunker must be large enough to take the whole of the coke from one discharging of all the retorts. After attending to the retorts, the stoker runs off the coke from the bunker into trolleys, and takes it to the stock heap. Reckoning 1·6 tons of coke per shift, three trolleys would be filled, and the time occupied would be one hour.	For conveying coke to the stock heap and quenching it one man is required at night. In the daytime the work is performed by the labourer who breaks and wheels the coal. It will occupy him half-a-day.	Six trolleys would be filled per shift. The stoker attends to the retort setting and to coal and coke transport.	One man is required per shift, making two men in all.
Wages.	Three men at 5s. 9d. = £0 17 3 The men are not fully occupied in the summer.	Four men at 5s. 9d. = £1 3 0 Two ,, ,, 4s. 6d. = 0 9 0 £1 12 0	Three men at 5s. 9d. = 17s. 3d.	Six men at 5s. 9d. = £1 14 6 Three men at 4s. 6d. = 0 13 6 £2 8 0

	For the Summer Make of 87,500 Cubic Feet per Diem.						For the Winter Make of 175,000 Cubic Feet per Diem.					
	Settings of Three Rows of Vertical Retorts.			Semi-Producer Settings of Horizontals.			Settings of Three Rows of Vertical Retorts.			Semi-Producer Settings of Horizontals.		
Cost of the Gas.	Tons.	£ s. d.	£ s. d.	Tons.	£ s. d.	£ s. d.	Tons.	£ s. d.	£ s. d.	Tons.	£ s. d.	£ s. d.
Dr.												
Coal, at 20s. per ton	7	= 7 0 0		8·3	= 8 6 0		14	= 14 0 0		16·6	= 16 12 0	
Power		0 0 4			..			0 0 8			..	
Coke used as fuel, at 16s. per ton, 18 per cent. for the verticals, 20 per cent. for the horizontals	1·26	= 1 0 2		1·66	= 1 6 7		2·52	= 2 0 4		3·32	= 2 13 2	
Wages		0 17 3			1 12 0			0 17 3			2 8 0	
			8 17 9			11 4 7			16 18 3			21 13 2
Cr.												
Coke obtained, at 16s. per ton	4·9	= 3 18 5		5·88	= 4 14 1		9·8	= 7 16 10		11·76	= 9 8 2	
Ammonia, at 3½d. per lb.	0·0224	= 0 13 5		0·02	= 0 12 0		0·0448	= 1 6 10		0·04	= 1 4 0	
Tar, at 30s. per ton	0·38	= 0 11 5		0·41	= 0 12 4		0·76	= 1 2 10		0·82	= 1 4 8	
			5 3 3			5 18 5			10 6 6			11 16 10
			£3 14 6			£5 6 2			£6 11 9			£9 16 4

ECONOMY PER DIEM.

Summer.		Winter.	
87,500 cubic feet of gas with horizontal retorts cost	£5 6 2	175,000 cubic feet of gas with horizontal retorts cost	£9 16 4
,, ,, ,, vertical ,, ,,	3 14 6	,, ,, ,, vertical ,, ,,	6 11 9
Saving	£1 11 8	Saving	£3 4 7

Therefore the average saving per diem is £2 8s. 1d., and the economy in a year amounts to about £877.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Meeting of the London and Southern District Junior Gas Association was held last Friday, at the Westminster Technical Institute, Vincent Square, S.W., under the Presidency of Mr. J. G. Clark, of the Gaslight and Coke Company.

The business consisted of the reading and discussion of a highly practical paper on a subject of interest to the general body of members; and it is to be regretted—particularly in view of the fact that it was accompanied by many blackboard demonstrations—that (from a variety of causes) there was not a larger number present. Without the sketches and explanations of them given by the author, parts of the communication would lose much of their point in print; but we give such parts as seem best suited for reproduction. The author was

Mr. F. Caudwell, of the Gaslight and Coke Company, who took for his subject the

DOMESTIC AND INDUSTRIAL USES OF GAS.

After some preliminary remarks on the advance of the industry, the education of workmen, &c., Mr. Caudwell proceeded as follows.

Low-Pressure Lighting and Heating.

To commence with lighting, one, of course, turns to burners; and probably at this point it would be well if we consider the principles upon which the construction and working of these depend. The formula, as you are aware, is based upon the injector principle; the gas entering the mixing-tube and drawing in its supply of air by reason of its velocity. Let us consider this action from a theoretical standpoint.

D = weight of 1 cubic foot of gas.
H_1 = pressure in inches head of water.

1 cubic foot of water weighs 62 lbs., therefore the pressure in pounds represented by H_1 inches would be $\frac{H_1}{12} \times 1$ ft. $\times$ 62 lbs. per square foot.

Kinetic energy is that energy which a body is capable of exerting by reason of its velocity. A stationary body falling from a height increases its speed at the rate of g, which is a known figure (32·2 feet) per second (London). Now imagine a vessel 1 foot cube, and filled with gas, the weight as per formula. The pressure in this vessel = H_1 inches head of water. Take a vessel much higher, but having a base of the same area as the cube. The pressure of gas, as formerly stated, is H_1 inches head of water—that is to say, a volume of water H_1 inches deep by 1 foot square will balance this pressure in the cube. The height in feet, therefore, of a vessel of gas having an end elevation of 1 square foot, and containing gas equal in weight to a volume of water 1 foot square and H_1 inches high, is easily determined by the following formula:—

$$H = \frac{H_1 \times 62}{12 \times D}$$

where H = height of the column of gas in feet.

Adverting again to mechanical formula, the velocity of a body falling from a height may be obtained from the following:

$$V = \sqrt{2gH}.$$

Insert the above value for H,

$$V = \sqrt{2 \times 32{\cdot}2 \left(\frac{H_1 \times 62}{12 \times D}\right)}$$

By inserting the values for H_1 and D, therefore, the velocity of gas from an orifice under pressure, and of a known density, may be obtained.

Now take the case of the ordinary incandescent burner at a pressure of 20-10ths and gas of specific gravity ·5 The weight of 1 cubic foot of air at N.T.P. is 0·078 lb.; so that 1 cubic foot of gas would weigh about 0·04 lb. Therefore—

$$V = 18{\cdot}2 \sqrt{\frac{2}{\cdot 4}}$$

$$= 129 \text{ feet per second.}$$

This calculation is, of course, quite theoretical, and does not take into account the effects of friction at the injector. But it is interesting and useful for our present purpose.

If the air-adjuster of an ordinary laboratory bunsen burner is manipulated, a variation in the structure of the flame will be noticed. The cone of the flame becomes shorter as the quantity of air admitted is increased, until it finally fires-back, because we say it has too much air. The disturbance known as back-fire is due to the change of two velocities:

(1) The change in velocity of the bunsen mixture through the tube.
(2) The change in velocity of propagation of the flame through the mixture.

Velocity of Mixture.

The velocity of the bunsen mixture through the tube is largely dependent upon the momentum of the gas-stream issuing from the nipple. The momentum of the gas is imparted to the air in the tube; and the mixture moves along at a certain velocity, depending upon—

(1) The quantity of air entrained with the gas.
(2) The section of the bunsen tube

Velocity of Flame.

The velocity of propagation of flame through a self-burning or explosive mixture depends almost entirely upon the quantity or composition of the mixture increasing up to a certain point with increased aëration.

The stability of the flame of (say) an inverted burner depends upon an equilibrium between the downward velocity of the bunsen mixture and the upward velocity of the flame. This stability may exist over a considerable range of variation in the air supply; but the shape of the flame will undergo a marked change. The brilliant green zone which marks the boundary of the inner cone of the flame is probably the zone of equilibrium between the flame velocity and the velocity of the issuing mixture. When the quantity of air is increased, the flame velocity increases, and the bright green zone approaches nearer the nozzle, until it is again in equilibrium. This goes on with each increase in the quantity of air admitted, until finally the velocity of flame propagation slightly exceeds the velocity of the mixture, and we get back-fire. When it is required to aërate the mixture to a high degree, some means must be adopted to overcome the rapid rate of propagation of the flame; and for this purpose higher pressures, self intensification, and compressed air are resorted to.

In the case of inverted burners, the effect of heat upon the degree of aëration attained must be taken into account. The more intensely heated a burner becomes, the less is the power to entrain air into the mixing-tube. This is principally due to two causes—

(1) The increased ascensive force due to the lower specific gravity.
(2) The increased friction due to the higher velocity resulting from the expansion of the mixture.

In regard to (1), the flow of the mixture in inverted burners is contrary to its natural gravity; and this becomes more so when the mixture is heated, because of expansion. More work must therefore be done to get the mixture down to the flame; and, as a result, less air is entrained.

In regard to (2), the increased friction due to the higher velocity is only partly compensated for by the reduced specific gravity; so that the new effect is to increase the friction, and so reduce the amount of air entrained.

Construction of Inverted Burners.

Passing now to the construction of inverted burners, it will be interesting to consider the advance made in recent years. It seems but a short time since this burner made its appearance; and one well remembers the early difficulties which it brought, which caused us to wonder whether the inverted type would really become a success. Time, however, has proved the contrary; and who of us would not now recommend this burner in preference to the upright type?

The construction of the injector plays a most important part in the arrangement of any burner; and I cannot help feeling that perfection in this direction is not yet reached. A variety of adjusting nipples are available now; but it is important to remember that, to obtain the maximum efficiency, the symmetry of the aperture should be preserved under all conditions of adjustment, so that the jet of gas is projected centrally into the mixing-tube.

In good burners, the length of the inner cone should not be more than ¾ to 1 inch long, after the burner has been lighted a few minutes; and provision must also be made for taking the products of combustion away from the primary air supply.

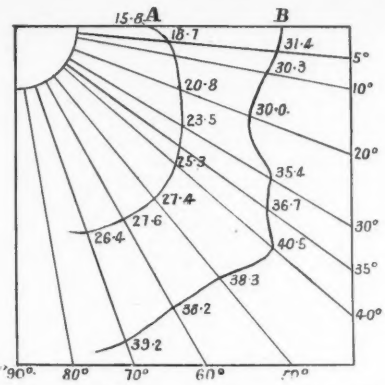
Self-Intensified Lighting.

This method has much to recommend it, owing to the possibility of producing fairly large units without the necessity of employing expensive plant. For this reason considerable attention has been paid to the subject at various times. Of the earliest forms of this type of lamp, we have the Lucas and Welsbach, which derive their additional power from the use of long chimneys. The "pull" of the chimney acts on the primary and secondary air supplies of the burner, thereby increasing the aëration and velocity of the mixture, and, in turn, the flame temperature and illuminating efficiency. The principle is simple; but the long chimney precludes its use in some circumstances. Other methods of self-intensification are by means of mechanically-driven appliances; the power being supplied by waste heat from the flame. The Scott-Snell and Thermopile lamps are examples of this.

The self-intensifying principle has been recently very successfully applied to the inverted system of lighting. The advantages obtained are due entirely to the scientific application of superheating, and do not involve the use of mechanical appliances. An efficiency of over 40 candles per cubic foot of gas per hour is procurable in this way. Fig. 1 shows two polar curves drawn from readings taken from an ordinary three-light inverted lamp and also a three-light "Nico" self-intensified lamp; the consumption of gas being 11 and 18·5 cubic feet respectively.

High-Pressure Lighting.

Within the last few years, great success has attended efforts made in this direction; and the lighting of the principal streets of the Metropolis provides a splendid example of what has been done. First, we had the 8-inch pressure system; but this has been increased by various stages until 60 to 80 inches are quite common. Personally, I feel that before long greater results will have been attained by still higher pressure—viz., pounds per



A.—Three-Light Inverted Lamp. B.—Three-Light "Nico" Inverted High-Power Self-Intensifying Lamp. Consumption of Gas, 11 and 18·5 Cubic Feet per Hour respectively.

Fig. 1.—Polar Curves showing Values Obtained in Candles per Cubic Foot.

square inch instead of inches head of water—not so much for lighting as for heating purposes. The reason for the increased efficiency is to be partly found in the accelerated rate of combustion due to the increased aëration, and to the pre-heating of the mixture before admission to the flame. Both effects tend to increase the flame temperature; and when it is remembered that 1 per cent. increase in the absolute temperature of the mantle increases the luminous emission by 12 per cent., the explanation is clear.

High v. Low Pressure.

Coming now to the subject of high *versus* low pressure systems of producing large units of light, as has been pointed out, the low-pressure systems have much to recommend them, owing to smaller capital outlay; but recourse must be made to high pressure when very large units are required. It would seem that before long the choice between high and low pressure will become difficult, owing to the rapid advance of the latter, unless still further progress is made in the former. Each system has its special field of usefulness. For heating and industrial purposes, however, there is no doubt high-pressure gas is a most useful commodity, and will be a valuable aid to the future development of the gas industry.

Gas-Fires.

It is not my intention to go deeply into this subject; but here, again, great strides have been made in the construction of this class of apparatus, with a resulting increased efficiency.

The chief points are: (1) Depth of fuel; (2) decreased gas consumption; (3) construction and method of fixing fuel in fire; (4) construction of the burner and formation of the flame; and (5) abandonment of the fire-bars.

The old method of fixing a fire in the grate, when the fuel was simply thrown on, was, indeed, most crude; and cases are very seldom met with at the present day. Personally, I am not in favour of the fire in the grate unless the grate is an up-to-date one, and has a sloping fire-brick back which forms a good reflector, and also has the bars as wide apart as possible.

I recently had the opportunity of making an observation of the distribution of radiation in various directions round a gas-fire, and was interested to find that the removal of the bars from the front of the fuel not only altered the amount but also the distribution of radiation from the fuel. The increase in the sideward direction was greater than in the front—a distinct practical advantage. It is generally stated that the iron-frets give off more heat than the fire-clay fuel; but the former do not appeal to the public, owing probably to appearance. The fire-clay fuel always looks well, whether the fire is alight or out. One is tempted to ask, therefore, Has perfection been reached in the construction of the fire-clay fuel?

Some time ago, mention was made of introducing a proportion of ceria into the fuel, with a view of increasing the radiant efficiency. It was thought that the high radiating power of the ceria would materially increase the efficiency of the gas-fire. Nothing has since been heard of the idea, though in the meantime appreciable progress has been made in the fuel in other ways. Repeated tests have shown that 55 per cent. of the total heat of the gas is obtained in the form of radiation. The acme of perfection in the construction of a gas-fire is, no doubt, the single fuel, duplex tap (for large fires), with a burner of the venturi type, and gas and air under control.

Having this fire at our disposal, we come now to the fixing. Many fires are fixed under not at all ideal conditions; and who of us has not seen a small fire fixed in front of a large grate, with no protection whatever from the terrific updraught which is experienced in some cases? We must not forget that both radiant and convected heat are given from the fire; and it is necessary to get as much as possible of this heat into the room. It has been said that the provision of a damper is detrimental to the use of gas-fires; but I have in mind a place where not a single fire is fixed without a damper, and think I am correct in saying that quite 5 per cent. increase in efficiency is obtainable. I have also seen them fixed on geyser flues; and a marked difference in temperature of the issuing water is noticeable. Of course, the use of the damper must be explained to the consumer.

Down draughts must, of course, be dealt with on their merits; and no set rules can be laid down for any one case, as demonstrated by Mr. E. W. Browning in his excellent paper last session. I have known cases where a fresh air supply carried to the point of combustion has remedied the defect. Fig. 2 illustrates a case

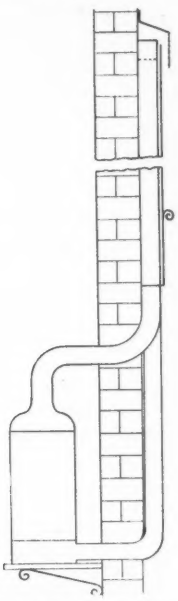


Fig. 2.—Showing Method of Overcoming Down-Draught to Geyser.

in which the down draught was made, as it were, to balance itself; the geyser in question being fixed in a house which stood at the top of a hill. No flue was near to carry the flue-pipe into, and something had to be done or the geyser removed. The plan has given every satisfaction; and no trouble has since been experienced. The principle of the whole thing is that the draught is made to balance itself; and the idea lends itself for adoption in a good many cases where difficulty arises with gas-fires. The trouble is caused through difference in density of the air in the room and that of the flue; and if this be remedied, no trouble will ensue.

In fixing heating arrangements, one method of obtaining a greater efficiency from a fire fitted in front of an existing grate occurs to me, and that is the heat-box (see fig. 3). I am not

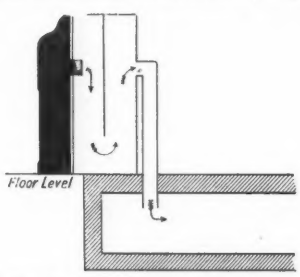


Fig. 3.—Showing Heat-Box and Flue Arrangements.

aware whether any of our members have tried this system; but personally I have found it most useful. If constructed to coincide with the fire-place, I do not think it will be found to look inartistic in appearance; and the advantages to be gained by its use are apparent. There is a certain amount of condensation, which, however, may be catered for by placing some sand in the base of the apparatus.

After discussing the different methods of distribuiion of hot water and the systems now in use, the author proceeded to the subject of

Gas for Industrial Purposes.

A paper might well be written on this matter alone; and it is not my intention to go deeply into it, as I am aware of the interesting paper given by Mr. L. F. Tooth, in which he furnished details of the plant in operation at the works of the Commercial Gas Company for metal-melting purposes.

Of the two methods of heating—blow-pipe flame and high-pressure gas—the former was, I believe, first in the field. The furnace consisted of a fire-clay box, in which the crucible was placed; and the gas and air entered at the base of the furnace and at right angles to it, passing round the crucible, and out at the top. With a 60-lb. crucible, and using copper, experiments were made with this class of apparatus. The details were as follows: Gas at ordinary pressure; air at 5 lbs. per square inch; time taken, 60 minutes; gas consumption, 300 cubic feet. This was rather a crude method of working, as it was impossible to tell when the construction of the flame was correct, and it was also impossible to keep an even pressure, which was necessary for efficient

working. Further, trouble arose with the crucible, which, after having been in use three or four times, would break up when being lifted from the furnace, causing much delay and inconvenience to those concerned. This, of course, was due to the oxidizing effect of the flame on the crucible, and emphasized the necessity for a reconstruction of the apparatus. The air pressure was omitted, and gas at 54 to 60 inches pressure was used; and, to quote Mr. Tooth's figures, nine charges of 60 lbs. can be heated by 1780 cubic feet, which equals 198 feet per charge—showing a saving of 102 cubic feet on the blowpipe system.

The construction of the furnace and nature of materials is a most important consideration, and, to my mind, is an art in itself—the space for combustion varying with the specific heat of the metal to be melted and the desired temperature to be attained. If of a high specific heat, the space allowed must be small; and if low, naturally it follows that a large space may be allowed. Regarding the burner, it has been found that better results are obtained by having one or more burners entering the furnace, in order that the heat may be distributed more evenly.

As to the burner itself, difficulty was experienced in inducing sufficient air. It was noticed that increases in pressure did not cause a corresponding increase in the amount of air drawn in; and the mixture was incorrect. To get over this difficulty, the injector was made so that it could be moved nearer to, or away from, the burner-head, which was fitted with a cone the angle of which I believe was about 60°. The air being drawn in at an angle with the gas-jet, was more thoroughly mixed; and the quantity entering was regulated by the adjustable injector.

The foregoing, of course, deals with apparatus for purposes where a high temperature is required and large quantities of heat, and where it is necessary to have the largest possible supply of primary air efficiently mixed with the gas before combustion. Mention must, however, also be made of those furnaces in which low-temperature heats are required, and where it is not an advantage to have a large supply of primary air. These are, of course, worked with a natural draught, and, as an example, mention may be made of the muffle-furnace. But in all systems, no matter how arranged, the highest efficiency must be sought after; and if even a 1 per cent. increase is to be obtained, no effort must be spared to get it, as we must not forget that we have a competitor in the form of producer gas.

Heating by high-pressure gas presents to my mind a large scope for gas engineers, when it is considered that the results obtained by the combustion of gas in this manner approach nearer to the ideal theoretical and practical conditions. Of course, the one drawback is the compression of the gas, as it would not be economical to put in a compressing plant for each individual installation. But when we have (as I believe we shall have in the future) means for supplying gas at a much higher pressure than is now the rule, we shall see more attention given to this matter.

I was rather interested some time ago in having a case brought to my notice in which a hot-water system of radiators was heated with high-pressure gas. The cubical contents of the hall were about 8400 feet; this being heated to a normal temperature by a consumption of about 80 cubic feet of gas per hour—an average of 105 cubic feet of air to 1 cubic foot of gas. When it is considered that, for ordinary heating (say) by a gas-fire and radiator the average is about 1 to 40 or 50, the economy to be effected is obvious. These, of course, are quite rough calculations.

In conclusion, mention must be made of the principle of surface combustion as applied to the melting of metals. The phenomenon has, I believe, been recognized for some years past by scientists and engineers; but not until recently has it been applied to this purpose. The valuable work and prominence given to the subject by Dr. Bone, of the Leeds University, has been reported in the Technical Press; and a perusal of the details convinces one of the opening of a new field for the development of the use of gas. The subject, however, is at present only in its experimental stage; and we anxiously await the results of further research.

Discussion.

Mr. S. A. Carpenter (Mill Hill) said he had been rather interested in the description of the heat-box. It sounded as though one should secure greater efficiency from its use; but, if this was the case, why had it not been generally taken up by the makers? He had an idea that at any rate one firm did have a fire constructed somewhat on these principles; but an objection to the heat-box appeared to be the risk of not getting sufficient draught. The flue under the floor, too, was rather an elaborate arrangement. Another original idea was taking a fresh air inlet from the chimney to the burner of the heating apparatus. He would, however, almost have thought a cowl on the top of the flue pipe would have prevented the back-draught. It would seem that if high-pressure gas was good for lighting it should be good for heating; but he thought that so intense a heat from a fire as could be obtained with high-pressure gas was hardly desirable. The ideal fire was a fairly large surface of comparatively moderate temperature.

Mr. B. H. Walters (Gaslight and Coke Company) understood the damper on the gas-fire was to be regulated by the consumers; and this would be a drawback, as it was hardly possible even to get them to regulate the fire with regard to the flame. The most suitable method was to regulate the draught of the chimney by the length of the flue. As to a heat chamber, this would take up a lot of room, and prevent the stove going close back to the fireplace, as was generally desired.

Mr. D. J. Winslow (Lea Bridge) said the paper contained some rather novel ideas; and one of these was in connection with the geyser and the special flue arrangement. Had the author tried taking the flue outside and carrying it well up above the roof of the house, and putting a cowl on top with a baffle inside?

Mr. W. E. Brown (Gaslight and Coke Company) did not agree with putting dampers into flues, principally because flues were not always pulling at the same rate. If one could be sure that the pull would be constant, of course a damper could be safely put in. With chimneys that varied very much in this way, to have anything in the shape of a baffle would be unsatisfactory. The author had alluded to the subject of iron frets. It was his own impression that the late Mr. Fletcher always considered this his best fire; and no doubt it was a very good one. Its advantages were put down to the superior radiating capacity of the iron fret; but he (the speaker) had often wondered whether the known greater efficiency of this type was not really due to the fact that it was a shallow fire, and not because of the iron fret. Of course, fire-clay fuel fires were at that time made very deep.

Mr. S. B. Chandler (South Metropolitan Company) remarked (with reference to the proposal to put a small baffle on the outlet of a gas-fire) that the tendency of to-day was to produce simplicity in all classes of appliances that were pushed by the gas industry. A good many cookers had these baffles on the back of the oven; but they were liable to be left alone, and not touched. Simplicity in arrangement was the thing to be sought after.

The President remarked that the author had dealt with the mechanical theory of the bunsen burner, as far as the injector was concerned; but to deal with it beyond this—namely, in the bunsen tube—was rather difficult. He (the President) knew something about this matter himself; and he thought it was a subject where mathematics failed. The conditions to be taken into account were so varied. They could not be reduced to mathematical terms. The subject was a purely experimental one. Mr. Brown had referred to the radiation from iron frets, and spoke of their supposed superiority as compared with the ordinary fire-clay fuel. It was often stated that the iron fret itself radiated a larger amount of energy; but he was inclined to think with Mr. Brown that this was wrong. At any rate, the difference was not so much as they were led to believe. He thought, however, that the supposed superiority of the iron fret type of fire arose from a different cause to that cited by Mr. Brown. The claims made for the superiority of the iron fret were in the days when there were no thermo-front fires with fire-clay fuel; and in his opinion it was the absence of the bars from the front that accounted for the apparent superiority of the iron fret. The iron-fret fire had always had a "thermo-front." Mr. Caudwell had told them what the removal of the front did with fire-clay fuel. It would quite account for the difference they were in the old days led to believe existed between iron and fire-clay. As a matter of fact, he thought (though he had not had an opportunity of investigating the question) that the fire-clay fuel was actually rather better as a radiator than iron frets. Of course, the shallow fuel made a difference; but it had been shown that the removal of the bars would almost fully explain the matter. He was glad that Mr. Caudwell had touched upon the question of radiation *versus* convection. Mr. E. W. Browning some time ago showed them the advantages of a certain amount of convection to supplement the heat from radiation; but, as Mr. Browning pointed out, it should be low-temperature convection.

Mr. Caudwell, in reply, said that the heat-box to which he had referred was made to meet a special case. With reference to the instance cited of a cure for down-draught, he did not think a cowl would have been sufficient. In fact, it was tried. His reference to high-pressure gas for heating was intended to be in connection with large requirements. Some objection had been raised in the discussion to the use of dampers; but personally he believed in them. As regarded iron frets, he agreed with Mr. Brown about the point he made as to the advantages due to the shallow fire.

Before the members separated, a hearty vote of thanks was passed to the author, on the proposition of Mr. Carpenter, seconded by Mr. E. G. Stewart.

On Saturday afternoon, some of the members paid a visit to the International Smoke Abatement Exhibition at the Agricultural Hall, where, after an inspection of the different stands, they had tea together. The proceedings were of an altogether informal character; but before rising from the tea-tables, Mr. Clark made some interesting remarks with reference to the importance of gas in abating the smoke evil.

Masonic—Evening Star Lodge.

The installation meeting of the Evening Star Lodge, No. 1719, took place at the Freemasons' Hall, London, last Wednesday, when W. Bro. Charles W. Offord, of Enfield, was installed in the chair for the coming year. The officers of the Lodge subsequently invested are as follows: I.P.M., W. Bro. Cyril G. Davis; S.W., Bro. W. Edgar; J.W., W. Bro. E. G. Smithard; Treasurer, W. Bro. Thomas Cash; Secretary, W. Bro. W. T. Dunn, L.R.; S.D., W. Bro. A. E. Croager; J.D., Bro. J. F. Wicks; I.G., Bro. A. P. Main; D.C., W. Bro. W. A. Surridge; Steward, Bro. Fred. West; Steward W. Bro. H. W. Packham; Steward, Bro. S. Carpenter; Organist, Bro. J. F. Simmance.

IMPROVEMENTS IN PUBLIC LIGHTING BY GAS.

Lecture by Mr. Henry F. Cotton.

At a recent meeting of the Engineering and Scientific Association of Ireland, held in the New College of Science, Dublin, a lecture, on "Modern Progress in Street Lighting by Gas," was delivered by Mr. Henry F. Cotton, the Superintendent of Public Lighting, Gas Examiner, and Inspector of Meters. It was illustrated by eighty lantern views, showing the appliances used in public lighting and the high-pressure systems in London, Berlin, and cities abroad, as well as the improved lighting in Dublin, Liverpool, and elsewhere.

The lecturer began by briefly referring to the early methods of street lighting by oil-lamps, hand and suspended, and then passed on to the introduction of pillars carrying lanterns fitted with rat-tail burners. One of the earliest public gas-lamps was put up in Liverpool in 1817. Many improvements were made in the form of lantern and burner, and various types of reflectors were employed; but greater lighting efficiency could only be obtained by increasing the consumption of gas. A 20-candle gas only gave the light of 20 candles with a consumption of 5 cubic feet per hour, or 4 candles per cubic foot. Flat-flame burners, however, eventually gave place to those of the argand type; and lamps fitted with multiple argand burners, produced by Mr. William Sugg, were employed early in January, 1879, for lighting the Waterloo Road. Waterloo Place and Regent Street were shortly afterwards selected as suitable areas for demonstrating this system of lighting, which was carried out by the Gaslight and Coke Company at their own expense. The old lamps, giving a maximum of 9 candles with a consumption of 2¼ cubic feet of gas per hour, were replaced by others giving nine times the light with the same consumption. An interesting feature of these installations was the use for the first time of the flash-light bye-pass, burning 0·25 cubic foot per hour, whereby the gas could be ignited by simply turning on the main lever.

Following the multiple argand burner came improved flat-flame burners, used in clusters up to twelve; one, as a rule, being left alight to act as a pilot. These clusters were fitted in large open six-sided lanterns, with open glass tops and enamelled iron reflectors. It was in connection with these lamps that the idea first originated of supplying air through the top. It was found that admitting the air in this way kept the top of the lamp cool, and fed the flame at a temperature which increased the light. These improvements allowed of economy being effected in the public lighting. Anterior to the date of the introduction of the improvements just referred to, however, Mr. (now Alderman) Cotton, the Chairman of the Alliance and Dublin Consumers' Gas Company, invented in 1866, at which time he was Superintendent of Lighting in Dublin, a street-lamp of the hexagon pattern, for which he took out a patent. The top was made to lift off easily, to facilitate cleaning; and there was no door. Some of these lamps are still to be seen in the streets of Dublin, after 45 years' service.

Mr. Cotton next dealt with incandescent lighting, and pointed out that though the mantle was invented by Welsbach in 1885, it was not until some years later that it was first adopted for street lighting. This was the result of a general desire for more light. With the rapid advances in modern times, the greater competition in business, and the increase of traffic of all kinds in the streets, there has arisen a greater necessity for the introduction of means for ensuring the public safety. It is of the first importance, therefore, that the standard of lighting should occupy the thought and attention of engineers and lighting authorities. As evidence of the desire for more light, Mr. Cotton cited Dublin, in which city fifteen years ago the public were satisfied with units of light equal to 16 candles placed at intervals of 60 yards along the thoroughfare; but now they are not content with units of four times this power fixed at that distance, even in streets where there is not much traffic. He receives, on an average, 200 complaints in a year; and they are all in connection with cases in which more and better lighting is called for. Dealing with the subject of the requirements of modern public lighting, Mr. Cotton said the object should be to keep the light down on the footpath and illuminate the road surface. The centre of the light should be high enough to avoid interference with traffic owing to glare, but low enough to give the maximum lighting effect upon the roadway at the least cost. The greatest light from a gas-burner is obtained at about 20° from the horizontal; and its intensity diminishes as the angle becomes more acute. All lamps, therefore, should be provided with good reflectors. The roadway must be evenly illuminated. Patches of deep shadow, interspersed with patches of brilliant illumination, constitute the worst form of street lighting, and are dangerous to all kinds of traffic. The standard of lighting will, of course, vary with the thoroughfare. In Mr. Cotton's opinion, no street should have less than 0·007 candle per square foot at any part of it; and for good lighting 0·1 candle is necessary. The latter is obtained at a distance of 24 feet from a 75-candle power lamp placed 12 feet high. For the best lighting of roads, a large number of comparatively small units are better than a few light centres of great brilliancy.

The three classes of incandescent lighting, with high and low pressure and self-intensifying lamps, were next considered; and Mr. Cotton pointed out that in the second class the inverted burner is entirely superseding the vertical one on account of its greater efficiency and lower cost for maintenance. He described the Welsbach-Kern, the Bandsept, and the "Visso" burners, and those of the upright type made by Messrs. W. Sugg and Co. and Messrs. George Bray and Co. He then turned to inverted burners, which, he said without hesitation, undoubtedly led the way for efficient and economic street lighting, when used in a proper lantern. He exhibited and described a lantern of his own design made in the works of the Public Lighting Department of the City of Dublin. It is wholly of copper, the top being spun; and, with this exception, it is made entirely by hand. It is fitted with a flash-lighting trap-door; and when this is opened by the torch, gas is admitted to a small bunsen burner, which is ignited by the torch sending a long, thin flame to the mantle. This does away with the pilot-light, and obviates broken mantles and glass, as the torch does not go near them. Speaking further on inverted burners, Mr. Cotton remarked that while with an upright burner only 46 per cent. of light is thrown below the horizontal, and the maximum illuminating value is obtained at an angle of about 20° above it, with the inverted burner the maximum radiation is obtained at angles of 20° to 40° below the horizontal—from 63 to 65 per cent. of the light being thrown in this direction.

The ideal burner for public lighting should, in the lecturer's opinion, be of cast metal, strong in every part, and have fixed air and gas supplies; burners with gas and air regulators not being suitable for street work, as they are often in the hands of inexperienced lamp cleaners—men who upset the adjustment, and render the burner useless. A burner which he considers fulfils all the conditions required has been specially made for use in Dublin by Messrs. Mansfield, of Liverpool. It was the result of nearly a week spent by Mr. Mansfield and Mr. Cotton in making experiments to get a burner to suit the city. It has been in use for more than a year, and has a regular efficiency of 20 candles per cubic foot of gas. Reference was made to the "Nico" burner, one of which the lecturer had for inspection, as well as a single-burner lantern complete; and he mentioned some of the London thoroughfares in which these burners are employed. Other lighting appliances described were the "Windsor" and the "Regent" lamps. Passing to the low-pressure self-intensifying or regenerative system, Mr. Cotton explained that it comes between the low and high pressure systems; the earliest and most important types being the Scott-Snell, Welsbach, Podmore, and Lucas.

Coming to the inverted system of lighting, Mr. Cotton expressed the belief that it would in time supersede all other systems; among its many advantages being that it is shadowless, all the light is directed on to the roadway, cleaning is reduced to a minimum, and no glazing is required. He showed on the screen one of Sugg's single-light "Regent" gas-lamps, as erected in Tara Street, Dublin, and said that, in his opinion, "no lamp so justly deserves a premier place in low-pressure public lighting." He put the lamp under test, and in six weeks it had not required a mantle; and all the attention it demanded was an occasional rub of the glass bowl. Mr. Cotton is about to start the manufacture of this type of lamp in one of his own shops; and he is designing a pattern to embrace all the modern improvements. He showed one of Sugg's "1911" low-pressure lamps, and said the claim made for it of "more than 40 candles per cubic foot," was fully substantiated —indeed, as high as 43·8 candles was obtained. The "Nico" high-power low-pressure lamp, which had been extensively used in London, gave nearly 40 candles per cubic foot.

The attention of the audience was next directed to high-pressure lighting; and special mention was made of the "Pharos," the Keith and Blackman, and the Sugg systems. The lecturer said it was impossible, in the time at his disposal, to give anything but a brief sketch of these systems; and therefore he dealt only with the inverted type of lamp, which, he said, had quite displaced the upright, owing to its much greater efficiency. He then, by the aid of lantern views, explained the working of the different burners. A diagram of a Keith suspension lamp of 1500-candle power was exhibited; and also a view of a lamp adapted for fixing on pillars —details being shown by a series of slides. Mr. Cotton stated that these lamps require comparatively little attention, each portion being easily accessible, and any of the vital parts being readily removed and renewed without disturbing the whole lamp. Compressors were next described, and a few of the principal types were shown, and the high-pressure automatic controller was explained.

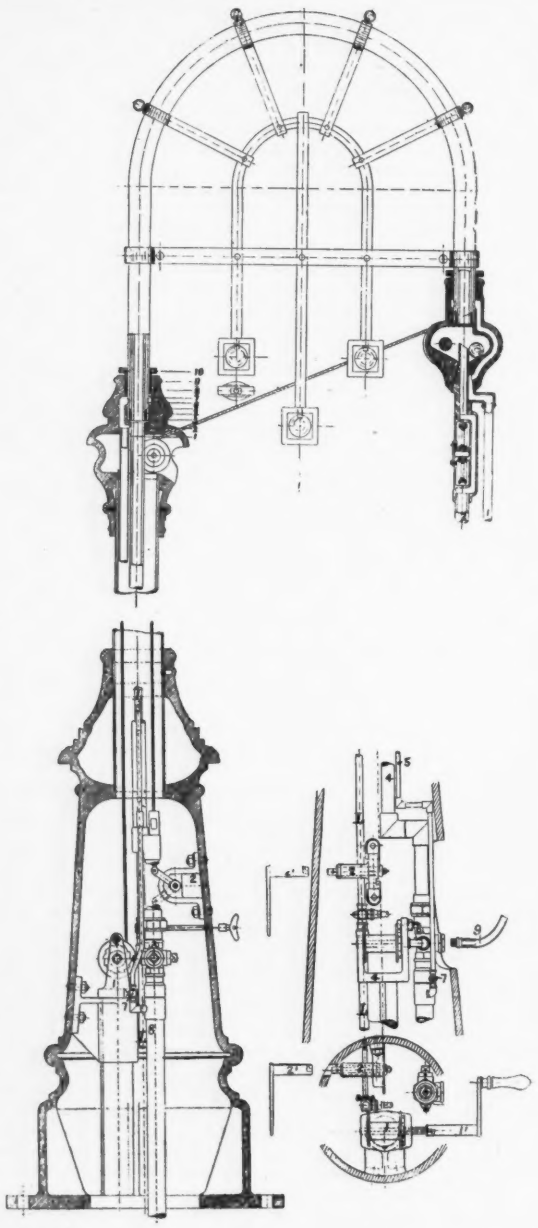
After a further reference to the "Pharos" system, and the excellent results obtained with it in Berlin (gaining for the city the credit of being one of the best lighted in the world), Mr. Cotton devoted the rest of his lecture to the improvements made in lighting and extinguishing gas-lamps. He pointed out that in the days of the flat-flame burner, the primitive oil-torch did the work very well; but with the advent of the incandescent mantle and the urgency of reducing vibration and shock, a better system became a necessity. This had been met by the introduction of the pilot-light, the flash-light, improved torches, and automatic lighting and extinguishing apparatus. Having briefly alluded to the first two systems, Mr. Cotton passed to the third. He explained that some form of open flame is necessary for inverted burners, as the torch must be kept well away from the mantle; and he mentioned the Simmance-Abady torch (which ignites a fine spray of benzene vapour, and sends a flame about 8 inches long up to the mantle) as being much used. In Dublin, he has overcome the difficulty by the introduction of acetylene torches, which are manufactured entirely to his design in the city. They have been in use for eight months with great success. Each torch is charged

daily with sufficient carbide to light a walk. They are made of cast brass, and fitted with Malacca canes. With regard to automatic control, which Mr. Cotton divided into two classes—viz., control of the entire system from one centre, and control of each lamp separately—he said the first system was the ideal one, and there were many devices to ensure its successful operation, and were all based on the pressure-wave principle. In this connection, he mentioned the systems of Dr. Rostin and Messrs. Alder and Mackay. As to individual control, the best-known systems in this country—those of Gunning and Horstmann—are operated by clockwork. He has had some of the former in use in Dublin for eighteen months, and they have worked without a hitch; but they are slower in action than the latter, which are instantaneous. Some of these are at the present time being installed in an outlying district of Dublin.

At the close of the lecture, there was a discussion, in the course of which the Chairman (Mr. G. E. Shannahan) and a number of prominent men in Dublin took part, and expressed their astonishment at the wonderful progress which has been made in public lighting by gas.

DEVICES FOR THE LOWERING OF COMPRESSED AIR HIGH-POWER GAS-LAMPS.

An article by Herr H. Wunderlich, the Works Superintendent of the Corporation Gas-Works at Carlsbad, on columns for suspending high-power gas-lamps with a high-pressure-air supply for street and yard lighting, appeared in a recent number of the "Journal für Gasbeleuchtung."



The author explains that while it is a more difficult matter to devise arrangements for raising and lowering high-pressure gas-lamps, fixed on lofty standards and brackets, than for electric arc lamps, the difficulty is increased when the lamps are supplied with gas at ordinary pressure and air at high pressure instead of merely with high-pressure gas. The ordinary devices for the purpose have the effect of rendering the standard or bracket relatively unsightly. The author is considering cases in which the light is suspended at a height of 40 or more feet from the ground. The gas supply pipe, in consequence of the low pressure, has to be of relatively large bore. In order, as far as possible, to secure the æsthetic advantages of electric lamp standards, in which wires or cables are contained within the hollow columns, the author has endeavoured to devise a standard for compressed air high-power gas-lamps in which the air and gas supplies are likewise taken through the interior of the column itself. In the base of the lamp column is a winch, with crank handle for raising and lowering the lamps, a three-way cock on the gas supply pipe, and a three-way cock on the compressed-air pipe, which cocks can be operated from outside. The two pipes run alongside one another up the interior of the column, while the supply of gas to the pilot-jet is carried outside by flexible metallic tubing from a point half-way up the column direct to the lamp, which is suspended from a semi-circular arm on the top of the column. The air supply pipe, on reaching the top of the column, enters the tube of which the semi-circular bracket is constructed, and the gas supply is carried direct to the free-end of the bracket. The lamp is connected to the gas and air supply by means of a special joint of the cone and socket type. When this joint is broken for lowering the lamp for attention, an automatic valve closes the gas supply, as a precaution in case the attendant has omitted to close the three-way tap in the base of the column before lowering the lamp. The illustrations show the arrangement of pipes as well as the head of the column.

The igniting and extinguishing of the lamp can be effected by increasing and diminishing the pressure of the air supply if desired; and the pressure wave may be made to extinguish one or two out of three burners in one lamp if all are not required after a certain hour in the evening. The author then describes the details of an arrangement for thus extinguishing one or two out of three burners in a lamp. The external flexible tubing for the supply of the pilot-jet has a bore of one-sixth inch, and an external diameter of ¼-inch, so that it has the appearance of being merely a wire.

VERTICAL RETORT WORKING IN AMERICA.

The Settings at Providence (R.I.) and Manchester (N.H.).

In the "JOURNAL" for the 7th of November (p. 383), we gave two papers, read at the last annual meeting of the American Gas Institute, by Mr. Carroll Miller and Mr. W. G. Africa respectively, describing the working of the settings of vertical retorts at the above-named places. They were discussed in conjunction with a paper by Mr. W. S. Blauvelt on "The Development of a Bye-Product Coke-Oven Gas Plant." A report of the discussion is now available; and we extract from it the portions bearing specially upon the papers on vertical retorts.

Mr. MACBETH asked the authors as to whether the variations recorded between the flat-flame and the argand burners were constant.

Mr. FULWEILER said it was difficult to compare results if the coal used was not the same; yet they were probably of the same general type. It seemed probable that the apparently better results obtained by Mr. Africa might be due to the different methods of carbonization followed at the two plants, which he very briefly touched upon when mentioning the existence of free space above the charge in the Manchester vertical retorts. In the ordinary horizontal retorts, there existed a rather excessive, highly-heated free space above the charge at the top of the retort; and it was also known that in some types of vertical retorts which were completely filled, no free space existed. So they believed that the gas given off from coal was practically saturated with a mist of heavy hydrocarbons, and that some at least of this mist, if properly handled, was capable of fixation into gases and vapours carried by the bulk of the gas formed from the coal. Perhaps the efficient fixation of this vapour might explain the difference in the results obtained between the two systems. In the completely filled vertical retort, no free space was found to exist, so there could be no secondary fixation of the tarry vapours. But in the Manchester system, the free space could be regulated as to height and extent, and also the temperature. This free space was of considerable area; so that the polymerization which took place in the vapours was due, in large measure, to radiant rather than conducted heat. The difference in the action was apparent when one considered that in a horizontal retort charged practically full there was also a small free space; but the gas, in passing over the coal, was brought into intimate contact with the top of the retort, so practically all the heating was done by conduction. Furthermore, in the horizontal retorts the free space was in the upper part of the retort, which was also the hottest portion, because less heat was being withdrawn at that point, and one could not modify or control this temperature; whereas in the vertical system with a free space the temperature could be almost

anything one pleased in the top section, and could either enlarge or reduce the heated area. Comparing the analysis of the tars produced by the different systems of carbonization, correcting the observed gravity and coke for the effect of free carbon, it was found that the tars arranged themselves in the following series: Continuous verticals, ordinary verticals without free space, verticals with free space, chamber ovens arranged to produce illuminating gas, coke-ovens, low-temperature horizontal retorts, and high-temperature horizontal retorts; the corrected gravities rising steadily from 1·06 to 1·16, the free carbon rising from 3 to 35 per cent., the coke formed rising in about the same ratio, and the unsaponified material falling from 12 to a fraction of 1 per cent. All this tended to show that more and more complex hydrocarbons were formed in the tar as the temperature of polymerization arose or came into existence, effected first by purely radiant heat, but in the end by purely conducted heat. It seemed, therefore, that one must use the proper mean position where there should exist a certain definite amount of free space to effect polymerization, yet be able to regulate the temperature and effect it by purely radiant heat. With regard to the furnace fuel at Worcester, they appeared to use something approximating 19 per cent., and at Manchester only about 14 per cent. This seemed a considerable difference; but when they bore in mind that the two fuels apparently contained about the same fixed carbon and ash, the rate of combustion per square foot of grate had some effect upon it. At Providence they seemed to report about 14 to 16 lbs. per square foot of grate; whereas at Manchester it was found to be about 5 or 6 lbs.

Mr. Blauvelt pointed out that Mr. Miller gave them the coal handled per man per day; and he asked whether this was hand labour or what other item it included. He also asked Mr. Africa how the labour on his verticals compared with the figure given by Mr. Miller.

Mr. A. E. Forstall said, with regard to Mr. Miller's paper, he could not quite understand why the coal sampler did not work, being under the impression the coal was crushed before it was put into the storage bin for vertical retorts. If it was crushed, he thought the sampler should afford a very good sample. Referring to what Mr. Fulweiler said in regard to the difference between the effect of radiant and conducted or convected heat on the character of the gas produced, he thought that it would repay the members to go through the volumes of the "Journal of Gas Lighting," using as a guide the index published in the number for Sept. 12, 1911, and read the lectures and papers presented to Associations in Great Britain by the late Mr. William Young, who had gone into this subject very thoroughly. His experiments and deductions seemed to prove quite conclusively that there was a selective action of radiant heat, by which it broke down the heavier hydrocarbons into lighter and permanently gaseous ones; and if one could properly proportion the amount of radiant heat to which the gas is subjected, after it leaves the coal and before it leaves the retort, one could get very much higher results than if one did not have this effect of radiant heat. It always seemed to him a strong point in favour of vertical retorts that, by experiment, one got exactly the amount of free space, and therefore the amount of radiant heat, which gave the best results for the kind of coal that was being used, and in the actual process of working gave that amount of free space very closely without going to any refinement. It was possible to do this in a horizontal retort; but it was not so easy to get a like amount of space for each charge as in the vertical retort, where variations of a couple of inches in the depth of the charge would not make a very great percentage difference.

Mr. Hartman said, with regard to the Providence verticals, the results were all given per ton of 2240 lbs., and he reckoned that the gas per ton of 2000 lbs. amounted to 9880 cubic feet. It would be interesting to know something of the quality of coke from these verticals, and whether it was used in foundries as well as for domestic purposes. Carbon trouble seemed excessive with the Providence plant, the capacity being reduced more than 8 per cent.; and he noted sometimes that the charges shrank, probably from the bottom of the retort being too cold. But he suspected that it might be due to carbon. The pressure in the Providence retorts was given at from 10 to 12 inches of water during the first period of the charge, and from 3 to 4 inches during the last few hours. He did not understand why it should be so high. It must certainly interfere with the proper scientific operation of a coal-carbonizing system to have the difference of pressure so great in these intervals. With regard to the Manchester plant, it would be interesting to know something of the pressure in the retorts and the temperature outside of them, the temperature of the secondary air, and that of the stack gases. In the Manchester plant, a number of changes were made in order to adapt the retorts to size, and taper to the coal; and this appeared a very serious point with verticals. Again, the coal was a picked one; the slack being all taken out. He would be glad to know if there were any carbon troubles with the Manchester retorts; also how the breeze was handled. With vertical retorts, he understood there was a charge of 50 or 60 lbs. of breeze dropped into the retort before the coal was charged. This went into the mouthpiece, and when the charge was dropped the breeze mixed with tar fell out with the coke. He wished to know what means were taken to separate the breeze and tar from the coke, so as not to deteriorate the quality of the latter.

Mr. H. L. Doherty said it was a very easy matter to discuss the results obtained in the various carbonizing systems without getting anywhere, because they talked of cubic feet of gas in one case, then of candle power, and again of pounds of tar, but said nothing about what the tar contained. It was his belief that, instead of being a difference in the results secured, it was a difference in the division of the products—that was to say, in some cases what would go to the gas went to the tar, so that one had so many gallons of tar without knowing its nature or how much it contained in the way of illuminants. Consequently, they had no basis on which to compare. In the summer, when on his vacation, he attended the meeting of the Institution of Gas Engineers. The members had a very animated discussion in the meeting hall and many more outside of it; and the bone of contention between the various debaters might have often been settled by a standard method of determining the results obtained by carbonization. The first thing the Institute should do was to appoint a Committee to standardize methods of testing for carbonization; for if they did not do so, they would never be able to reach a conclusion. For instance, Mr. Fulweiler called attention to the results obtained in candle power at Manchester, which were probably due to the polymerization of the products in the top of the retort, so that what ordinarily went to the tar in the form of illuminants was given to the gas instead.

Mr. Miller, replying to the remarks upon his paper, said the difference in candle power between the flat flame and the argand burner was practically constant for a fixed candle power in the former; but the higher it was, the nearer the flat-flame and the argand approached. He thought there was no doubt that the empty space in the top of the retort increased the yield of gas. Their retorts were filled to within 6 inches of the mouthpiece. It was indicated that the yield was larger in Mr. Africa's case by the smaller yield of tar; his own yield being a great deal higher than that of Mr. Africa. He would ask him what were his average yields of tar and ammonia for the months for which he had given the results. The amount of coke per 100 lbs. of coal carbonized used in a producer was usually higher in the case of a small grate area and shallow fire than when a large grate and deep fire were used. For instance, in Worcester only about 6 lbs. per hour per square foot was burnt. He would ask Mr. Africa how much he burnt, and what was the size of his grate and the depth of the fire. The number of men at Providence was ten—five on each shift; and these charged and discharged the retorts and closed the fires. The coal contained a good deal of slack, and was evenly crushed, so that the largest lump was 2½ inches. They sold a good deal of coke for use in cupolas, and never found that the sticking in the retort was due to any accumulation of carbon; in fact, just after the retort was scurfed, the charge very often stuck worse than before. Perhaps Mr. Africa would tell him the length of time the coal stayed in the retort.

Mr. Africa said with regard to the amount of coal handled per man per day, as they had erected only two benches, they did not put in mechanical appliances; hence their coal handling per man per day was not quite so much as at Providence. As to the quality of the coke, at a branch of the American Locomotive Works at Manchester, they examined the coke, and wanted to use it in their furnaces; but so far his Company had such a demand for domestic coke that they had been unable to supply the locomotive concern. The coal used in the test was ¾-screened coal, screened at the mine and sent by rail. The ordinary coal was ¾-screened at the mines, sent by rail to tide water, loaded on a vessel, unloaded from the vessel into cars, and then dumped into the sheds, which broke it as fine as run-of-mine coal. The three months' test was with the better quality of coal. They had one particular trouble with the carbon, but not more than one would have with ordinary horizontal retorts. The quantity of breeze used in each retort was from half to three-quarters of a bushel; and this, after it had been mixed with the coke, crushed, and screened, did not injure the quality. The length of charge was nine hours. Mr. Miller suggested they did not give the tar and ammonia on the several months' tests. As they had some settings of horizontals, and it was necessary at times to run both jointly, it was difficult to keep the tar and ammonia separate during a period of several months; but they were able to do it for a number of weeks during the test, as the horizontal benches were shut down at the time.

Mr. Fulweiler said, with respect to the temperature in the benches, it was very much the same as that recorded by Mr. Miller—possibly a little bit lower. In the combustion chamber, the temperature was about 2500° Fahr.; and the temperature at the retorts was about 2200° Fahr. At the top, where the waste gas went into the recuperator, it was about 1600° Fahr. The actual temperature of the entering secondary air was somewhat higher—about 1800° Fahr.—due to the fact that they were conveying their air down again to admit it to the auxiliary combustion chamber, and in passing down it took up some little heat from the main chamber. As to the pressure in the retorts, he did not consider that 3 inches of water was a serious matter as affecting the carbonization of the coal. This was due to the fact that in the vertical retort they had a high column of coal and a small periphery, so that the area for the escape of gas decreased very rapidly. When first charged, there was no excessive pressure. Their tar had a gravity about 1·124, and contained about 8½ per cent. of free carbon. This gave a corrected gravity for the pure hydrocarbons of about 1087. The corrected coke would be about 30 per cent. of the tar. Their grate at Manchester had about 22·5 square feet of surface; and they burned from 5 to 6 lbs. of fuel per square foot per hour.

REGISTER OF PATENTS.

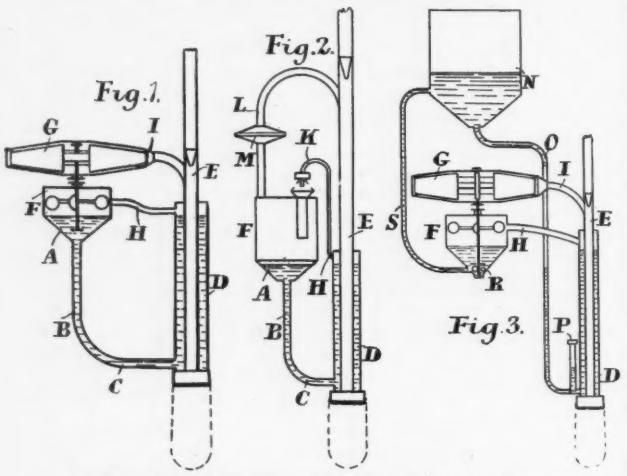
Compressing Air or Gas.

LIEBLICH, E., of Vienna.

No. 27,848; Nov. 30, 1910. Date claimed under International Convention, Aug. 3, 1910.

This invention consists in "generating motive power, in connection with illuminating or heating purposes, by heating mercury contained in a vessel by means of the illuminating or heating device itself; the vapour being then led to a power generator, which solely serves to effect suction and compression of the air or gas which is led to the place in the illuminating or heating device where it is to be used—the vapour, after performing work, being condensed, and the mercury utilized for another cycle."

The patentee remarks that "the low specific heat of mercury in comparison with all other fluids, and its high specific weight, enable evaporating receptacles of very small dimensions to be used, and at the same time a higher pressure is generated than is possible with water. The ease with which mercury vapour can be condensed, and the fact that at the temperature obtaining with the atmosphere, the mercury has only a low vapour pressure—that is, condenses rapidly—enables the very short vapour conduits and very small condensation chambers to be used, whereby a lamp or heating device may be worked with the same mercury for a practically unlimited period."



Lieblich's Compressing Arrangement for Incandescent Lighting.

Three constructional forms of the apparatus for carrying out the invention are shown diagrammatically—being primarily intended for supplying compressed air for the feeding of incandescent lamps.

Fig. 1 consists of a communicating system, A, B, C, D; and through the member D passes directly a gas supply pipe E, the lower end of which carries the burner. In the part A is arranged a turbine F, the spindle of which is led outwards, and carries a fan G. Mercury is placed in the communicating vessel; and on heating the mercury by the flame of the lamp it is evaporated, and the mercury vapour passes through the pipe H and drives the wheel of the turbine—thus actuating the fan and forcing air under pressure through the pipe I into the gas supply pipe E, and enabling the lamp to burn with compressed air. After leaving the turbine, the mercury condenses in the space A, and is ready to go through the cycle again.

The device shown in fig. 2 also consists in the same communicating system, together with a nozzle K. The mercury is evaporated by heating, and flows through the pipe H into the nozzle, where it sucks in air and presses it in the container F. This air flows through the connecting pipe L to the gas-pipe E. The mercury condenses in the space A, and, if necessary, a condenser M can be formed in the supply pipe L "to ensure reliable condensation."

In fig. 3, the mercury is placed in a reservoir N under pressure, and is led through a pipe O to a thermostatic valve P, which only opens when, by heating the mercury, the pressure in the reservoir has been overcome. The vaporized or gasified mercury flows through the connecting pipe H to the turbine F, drives the latter with its coupled fan G, and thereby causes air under pressure to be supplied to the burner through the pipes I and E. When its work is finished, the mercury condenses in the space R, in which is arranged a pump (also driven by the turbine), by means of which the condensed mercury is forced into the reservoir N.

Carburetting Gases.

MOSS, H. W., and CARROLL, J. S., of Dublin.

No. 5343; March 3, 1911.

In their specification (which is not illustrated), the patentees say: The gas or mixture of gases to be carburetted, and which may have already been partially carburetted by any known means, is saturated with water vapour, by bringing them into contact with jets of water or by mixing them with steam, or by bringing them into contact with surfaces moist with water "by any known means."

The proportion of water vapour in the gas or mixture of gases thus saturated, on leaving the saturator, will depend upon the temperature and pressure of the gas (or mixture) in the saturator. If the pressure be constant, the proportion of water vapour taken up will depend only upon the temperature in the saturator; and this can be controlled.

The gas (saturated as described) is brought into intimate contact with calcium carbide in a chamber termed a "carburettor," whereby the water vapour in the gas is replaced by acetylene, by chemical interaction with the calcium carbide. The proportion of acetylene thus formed in the gas will depend upon the proportion of water vapour present; and this again will depend upon, and be controlled by, the temperature of the gas in the saturator, if the pressure of the gas be constant. In the reaction between the water vapour and the carbide, heat is evolved, which may be utilized to (if needful) raise the temperature in the saturator.

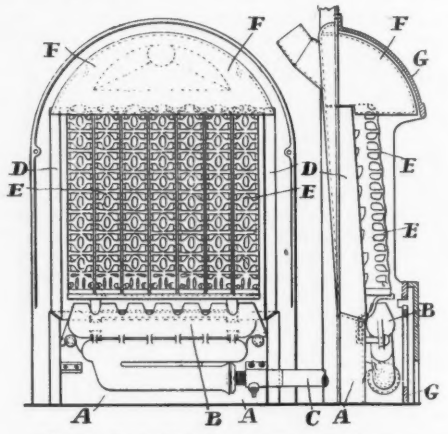
The means described for carburetting gas or a mixture of gases may be employed to increase the illuminating or heating powers of illuminating and heating gases, to confer illuminating properties on gases which burn with a non-luminous flame, or to render such gases as air combustible or explosive, "for the purpose of obtaining useful heat or work from their combustion or explosion."

Gas-Fires.

GLOVER, THOMAS, of Edmonton.

No. 10,140; April 26, 1911.

This gas-heating stove is so made that the back-plate carries "the burners, fire-brick, fuel, and all appliances to form a gas-fire except the front plate, which can be readily attached to the back." In this way various designs of fronts can be employed to gas-heating stoves with one construction of back.



Glover's Back-Plate for Gas-Heating Stoves.

The back is formed from sheet metal, and preferably with an outlet tube for the products of combustion near the upper part. Near the lower part of the back is a projecting portion A; and near the top of the projecting portion are holes for holding a grid. On the front of A are two lugs or screws, on which is suspended the burner B, preferably by hooks or extensions formed on it; and just below the lugs are excrescences (on either side), to one of which is secured the gas-pipe C. In the holes of the back are the arms of the grid, which has a position over the nozzles of the burners; and on the projecting portion of A is the fire-brick backing.

On the grid and over the burner nozzles is placed the tubular perforated fuel E, and above it and the outlet of the back (if one be provided) there is secured a canopy F, having projecting arms or a grid to engage the top of the fuel and hold it in place—the canopy further forming a hot chamber and directing the products of combustion to the outlet and chimney.

Thus, when connected up with the gas supply there is "a complete stove;" but to give it a "proper appearance as a stove," a designed front G is attached.

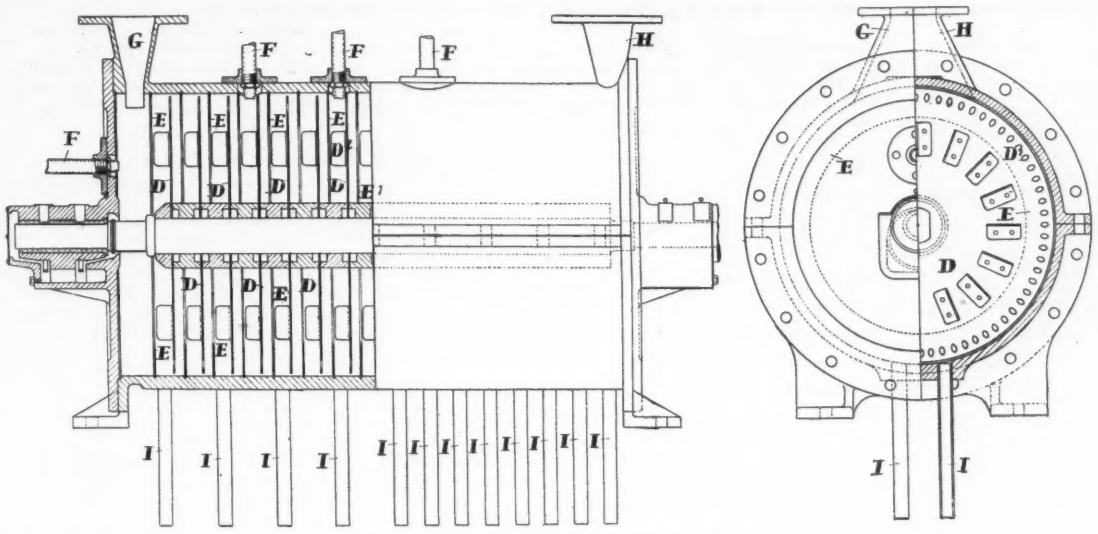
Centrifugal Machines for Separating Tar, &c., from Gases.

HUTCHINS, T. W. S. (Power Gas Corporation), of Stockton-on-Tees.

No. 11,653; May 15, 1911.

This centrifugal machine, for separating tar and other liquid or solid bodies from gases, has, "as its characteristic feature, a series of perforated rotary discs mounted upon a horizontal shaft which is driven at a high speed, so that, in addition to the gas being 'wire-drawn' during its passage through the casing of the machine, it is 'cut' by the perforated discs."

The machine (as illustrated) comprises a cylindrical casing, supported horizontally, and having a central bearing carried by each end plate. In these bearings is journalled a shaft driven by any suitable gear. On the shaft are fixed a series of discs D—spaced (say) 1 to 2 inches apart—and extending from the shaft to about ¼ inch from the interior of the cylindrical casing. The discs have on their outer edge small holes with wings or vanes fixed on them. Between the discs are placed an alternating series of annular plates or rings E, fixed to the casing and having a central opening of any required size. The rings may also be perforated, if desired, near their inner edge. Along the bottom of the casing is a trough in which a small quantity of water is placed, or (alternatively or in addition) a number of sprays F may be employed, so arranged that the water impinges on the rotating discs and washes the gases, which are introduced through the inlet pipe G



Hutchin's (Power Gas Corporation) Tar Separator.

at one end of the casing and leave through the outlet pipe H at or near the other end.

In operation, the rotating discs force the gas through the perforations near their periphery; the wings or vanes increasing the pressure of gas in the chambers between the rotating discs and the stationary annular plates E—forcing the gas through the perforations near the periphery. The gas then returns toward the centre of the cylinder, passing through the central opening in the next fixed ring and being again forced outward by the next rotating disc, and so on to the outlet pipe H.

Each of the three movements—namely, the piling up or increasing of the pressure, the driving of the gas through the peripheral perforations, and the return of the gas from the periphery towards the centre—assists in cleaning the gas and separating tar and other solid bodies from it. Further, the rotating discs passing through the water in the trough in the bottom of the cylinder cool the gas; and this cooling action is further increased by the water from the sprays F.

The tar and other solid bodies extracted from the gases with the superfluous water are drawn off from the cylinder through the pipes I, or the solid bodies may be removed in any other convenient and suitable manner.

Estimating the Percentage of Combustible in a Gaseous Mixture.

Levy, L. A., of Hampstead, N.W.

No. 20,692; Sept. 19, 1911.

There are, the patentee remarks, many forms of apparatus for gas analysis; but they usually require a fair amount of skill on the part of the operator. The present invention relates to apparatus by means of which the percentage of a combustible gas in a gaseous mixture can be determined by a comparatively unskilled observer. The apparatus can be used, for example, to determine the percentage of: (*a*) Carbon monoxide in coal gas, in flue gases from stoves, furnaces, and the like; (*b*) fire damp in the atmosphere of a mine; (*c*) sulphuretted hydrogen in certain impure gases.

A colour change method is employed. The gaseous mixture to be tested is passed through the apparatus to be described, and suitable means are employed so that the volume of the mixture passed through the apparatus can be measured. For example, the gaseous mixture may be contained in, and be discharged from, a gasholder, or be passed through a gas-meter, or be drawn or forced through the apparatus by means of liquid displacement.

The gaseous mixture is passed through a series of "absorption vessels," which contain reagents for the removal from the gaseous mixture of any gases which would interfere with the test other than the combustible gas the percentage of which is to be estimated. It is then passed through an "oxidation vessel" containing a reagent which completely oxidizes the combustible gas. For example, carbon monoxide will be oxidized to carbon dioxide, and sulphuretted hydrogen will be oxidized to water and sulphur dioxide.

The oxidation vessel is heated externally to a suitable temperature, and the gaseous mixture is then passed through a "decolorization vessel," in which is placed a known amount of suitable reagent which is decolorized by the action of the oxidized gas. The observer notes the volume of the gaseous mixture drawn through the apparatus at the instant the decolorization is completed. From this known volume and the known amount of decolorization reagent, the percentage of the combustible gas in the mixture is determined.

For the reagent in the oxidation vessel, iodine pentoxide, copper oxide, palladium, or other reagent is used, as "found convenient." When iodine pentoxide is used as the oxidizing reagent, the gaseous mixture, after passing through the oxidation vessel, is passed through a U-tube or other vessel containing copper shavings; the object being to remove the liberated iodine. Metallic palladium can be used in the apparatus for the analyses of certain gaseous mixtures (such as mine gas) which contain free oxygen.

When a gaseous mixture contains more than one combustible gas which is acted on by the oxidizing reagent employed in the apparatus, it is necessary to selectively absorb the unestimated constituent prior to the oxidation of the gas. Where several combustible gases are present, the possibility of the estimation of certain of these is necessarily affected by the limitations due to the nature of the particular absorbent reagents which have to be employed for the removal of the unestimated constituents. For example, in the apparatus for estimating carbon monoxide in coal gas, ethylene and acetylene must be removed by passing the coal gas through absorption vessels containing suitable reagents before being passed through the oxidation vessel.

Vertical Retort-Settings.

Leech, W. J. B., of Hunslet, Leeds.

No. 13,319; June 2, 1911.

According to this invention—applicable more especially where two or more sets of vertical retort-beds are arranged back to back in such a manner that either or any of them can be heated as required from a single outside producer by gas introduced by way of a flue placed in any convenient position—the secondary air is admitted through the lower part of the outer walls of the retort-setting, and is carried upwards and along the top of the setting, through suitably arranged

Fig. 1.

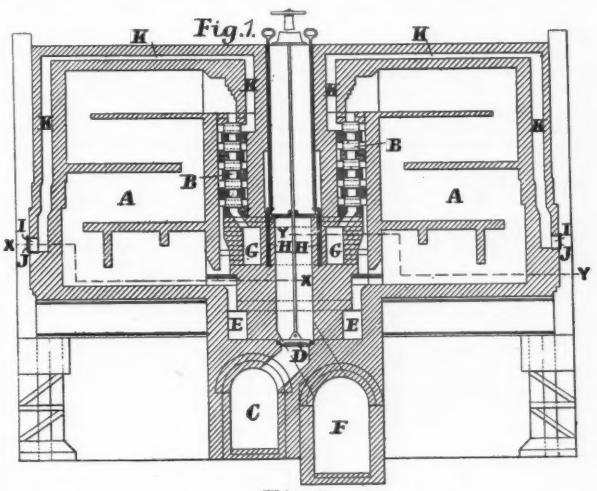
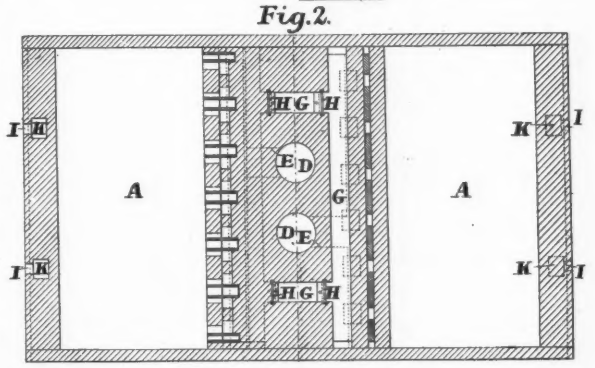


Fig. 2.



Leech's Vertical Retort-Settings.

flues to the regenerator—"thus collecting or absorbing heat which would otherwise be lost by radiation from the walls of the retort-setting, and returning such heat to the setting."

Fig. 1 is a sectional elevation of a duplex or twin setting having

such secondary-air arrangements. Fig. 2 is a plan in section on the lines X and Y.

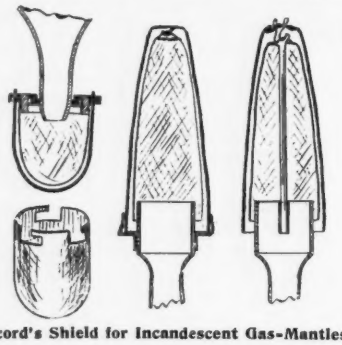
A are the retort-beds (any type) arranged back to back, with regenerators B, also of known type. C is the live-gas flue from the outside producer, with lift-valves D and separate side inlet flues E communicating with the retort-beds, so that either or both beds can be heated as required. F is the waste-gas flue; the regenerators communicating with it by way of flues G having separate dampers H. I are the secondary-air inlets with the usual adjustable slides J. These inlets I are arranged in the lower part of the outer walls of the setting: and the air is carried upwards and along the top of the setting through flues K to the regenerator—"thus collecting and absorbing a considerable proportion of the heat, which would otherwise be lost by radiation from the walls of the retort-setting."

Protective Coverings for Incandescent Gas-Mantles.

RECORD, J. W., of Gatley, Cheshire, and the RECORD ELECTRICAL COMPANY, LIMITED, of Caxton House, Westminster.

No. 18,108; Aug. 10, 1911.

This covering for incandescent gas-mantles is "to protect them from damage by draughts of air, or careless lighting with a match or taper, to increase the brilliancy of the light by causing greater intensity of heat, and also to intercept jets of gas issuing through holes in a damaged mantle, which would fuse the ordinary gas-globe."



Record's Shield for Incandescent Gas-Mantles.

From "pure fused silica or quartz, or nearly pure," the patentees propose to form a shield of any suitable shape to encase the mantle. The shield (open at one or both ends) is attached to the fitting or burner by slots or projections, or both, as shown. A variety of shapes of shields, and methods of fixing them can be made; the illustrations indicating three methods of carrying out the invention. The patentees do not construct the shields from any other material than "pure, or nearly pure, quartz or silica."

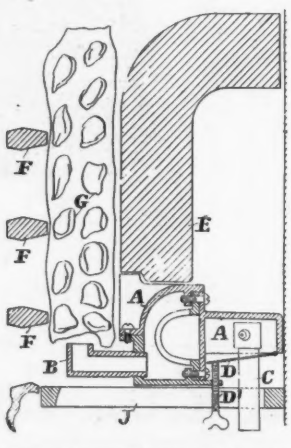
The invention does not claim a network of quartz for the purpose of supporting the mantle, neither does it claim a globe made of quartz in which the mantle is suspended from the top; but it provides a protecting shield for ordinary incandescent mantles which "can be readily changed from one mantle to another, and which does not in any way constitute part of the gas-mantle itself."

Enabling Coal Fire Grates to be Utilized for Gas.

FLETCHER, RUSSELL, AND CO., LIMITED, and FLETCHER, T. W., of Warrington.

No. 20,538; Sept. 16, 1911.

This invention relates to improved means for enabling an ordinary coal fire-grate, with either curved or straight bars, to be employed as a gas-fire without alteration in the structure of the grate, as shown in the illustration of the device and an ordinary fire-grate in combination.



Fletcher's Convertible Gas and Coal Grate.

A is a gas and air chamber constructed as described in patent No. 25,979 of 1908, with gas-burners B extending at the front; gas being introduced at the back through a pipe C, and air through the valve D, which is regulated by a screw. The device is placed within the fire-grate and rests on the bottom bars J, with the jets near the front bars F. A fire-clay tile E, above the device, retains the cobbles G in the front portion of the grate and over the gas-jets. The front ends of the gas-jets are arranged either in a straight or in a curved line as required for a grate whose bars are either curved or straight. By these means the same grate may be employed for either a coal-fire or a gas-fire.

APPLICATIONS FOR LETTERS PATENT.

6632.—CHURCHER, E., "Gas cooking-range economizer." March 18.
6672.—CARPENTER, C. C., "Furnace for heating apparatus for converting the sulphur in coal gas or like gases into sulphuretted hydrogen." March 18.
6690.—ROSTIN, H. P., "Gas-igniting." March 18.
6732.—BONE, W. A., and M'COURT, C. D., "Heating by gaseous combustion and the like." March 19.
6738.—BONE, W. A., and M'COURT, C. D., "Apparatus for use with explosive gaseous mixtures and the like." March 19.
6750.—SHILTON, W. A., "Hydraulic mains." March 19.
6764.—HIGGINSON, J., and ARUNDEL, H., "Gas and air mixing apparatus." March 19.
6847.—GIBBONS, W. P. & G. B. A., and MASTERS, E., "Gas and air passages of regenerative furnaces." March 20.
6886.—KIRBY, A., "Mantle guard." March 20.
6898.—LAKE, W. E., "Charging and discharging gas-retorts." A communication from Riter-Conley Company. March 20.
6907.—"DEUTSCHE HUTTENBAU-GES. M. B. H., "Gas-producers." March 20.
6917.—DYSON, J., "Generating and using heavy hydrocarbon gases." March 20.
6946.—MOSS, S. A., & A. G., "Cover for gas-lamps." March 21.
7019.—PAERÉN, T. W., "Lamps, heating apparatus, and the like, working under gaseous pressure." March 21.
7022.—BELL, J. D., "Acetylene-generators." March 21.
7079.—ALSTON, C. H. T., and HOUSTON, P. T., "Gas-producers." March 22.
7094.—PODMORE, A. E., "Globes or shades." March 22.
7099.—MÜCKE, J., "Inverted gas-light." March 22.
7172.—PATERSON, W., "Indicating and recording the flow of liquid." March 23.

Progress of the Southend Water Company.

Last Tuesday evening, Mr. C. S. Bilham, the Secretary and Manager of the Southend Water Company, delivered an address on the water supply of the borough, at a meeting of the Southend and District Chamber of Commerce. He began by giving a history of the waterworks, and described the geological conditions prevailing locally. In 1880, the Company had one well, and supplied a population of 5000; the average daily consumption being 64,000 gallons. In 1910, there were 21 wells, supplying a population of 73,759; the average daily consumption being 1,677,000 gallons. As the demand for water increased, they had had to go farther afield for sites for wells; and Parliament said they must supply the districts where the wells were situated. Last year, three more wells were brought in, making a total of 24; the population supplied being nearly 80,000. Describing the Vange reservoir in course of construction, Mr. Bilham said it would contain 17 million gallons; and the first section, holding about 8 million gallons, would be available for use by the end of May. The cost of the reservoir would be about £50,000. The second projected reservoir on the same site would have a storage capacity of 18 million gallons; so that when the whole scheme was completed the total storage on the Vange site would be about 35 million gallons. Taking in the other reservoirs, the total storage capacity would be 42½ million gallons. He hoped they would not be likely to have a recurrence of the difficulties experienced last year. The object of the new reservoirs was to meet such exceptional demands.

Cost of the Worksop Water Undertaking.—At the last financial meeting of the Worksop Urban District Council for the year, held last Tuesday, the Clerk was able to give the final figures connected with the cost of purchasing the Worksop water undertaking; the works having become the property of the Council in June last. He said the award was £64,613; the taxed costs, £2307; the stock, &c., £1433; the costs of the award, £469; the stamp duty on the transfer, £682; Counsel's taxed costs, £1750—making a total of £71,254. In addition, there were the parliamentary costs of promoting and passing the Bill (£2150); making a grand total of £73,404.

London County Council's Meter-Testing Staff.—At the meeting of the London County Council last Tuesday, the Public Control Committee reported that Mr. R. C. Arthur had resigned his appointment as inspector of the gas-meter testing office at Newington. In virtue of his continuous service since 1884, the Council could grant him a retiring allowance of £96 5s. per annum; and the Committee recommended that this should be done. They also recommended that Mr. G. F. J. Knott, clerk at Spitalfields gas-meter testing-station, should be promoted to fill the vacancy caused by Mr. Arthur retiring. Both recommendations were agreed to without debate.

Exmouth Gas Company.—Presiding at the annual meeting of this Company yesterday week, the Rev. C. R. Carr, the Chairman, said the shareholders had met under a cloud of trouble such as they had never before experienced; for they were at the crisis of the fate of every industry in the land, their own among them. The transition period of extension and modernizing of their works was nearly at an end. The various improvements in their plant were fulfilling expectations; and the policy of using sufficient capital to bring the works up to date had been fully justified. All they needed was cheap coal, which was absolutely essential to their welfare. Mr. L. D. Thomas, who seconded the motion for the adoption of the report, said there had been a satisfactory increase in the sales of gas and of residual products. The report was adopted; and it was decided to pay a dividend of 5 per cent. on the consolidated ordinary stock.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Studies in Carbonizing.

SIR,—I regret to have to point out two errors in my paper published in your last issue.

(1) On p. 880 it is stated: "Taking the figures as they stand, the total number of heat units would appear to be rather more with twelve-hour work than with six-hour work." This should read, "rather more with six-hour work than with twelve-hour work."

(2) In Table V., p. 886, the figures for "Make per Ton, Cubic Feet (Actual)" for the seventh hour to the fourteenth hour should be increased by 1000.

W. B. DAVIDSON.

Nechells Gas-Works, Birmingham, March 30, 1912.

Gas and Coke Supply at Derby.

SIR,—I notice on p. 911 of last Tuesday's "JOURNAL," under "Coal Strike and Gas Supply," that Derby is included in the list of towns where the public lighting has been curtailed in consequence of the coal strike. This applies to the streets which are lighted by electricity, as the Gas Company, so far, have been able to give a full unrestricted supply to all consumers, and no curtailment has been made in respect of streets lighted by gas. I may add that we are in a position to continue a full supply to all consumers for some time ahead.

I am sending you a marked paper, from which you will see we are taking advantage of the coal strike to popularize coke for domestic use.

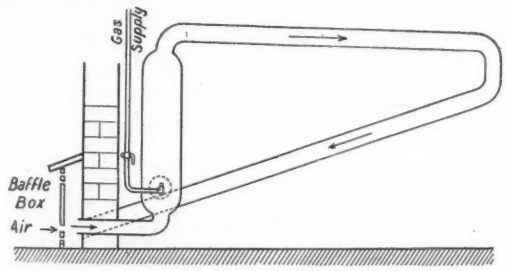
J. FERGUSON BELL.

Derby, March 30, 1912.

[The paper referred to by our correspondent contains an advertisement in a prominent position announcing that the Company have arranged to reserve the whole of their make of coke for local use; and that as the quantity produced is about 1000 tons per week, there is no necessity for any householder to be short of fuel. The price to those who obtain the coke from the works in small quantities will remain as at present—viz., 6d. for half-hundredweights, and 1s. for hundredweights. The current prices are: Ordinary screened coke, 23s. 4d. per ton at the works; broken coke, specially prepared for domestic use, 25s. do. If the coke is delivered by the Company's carts inside the borough, 1s. 8d. per ton extra is charged; for getting in 1s. a ton; and for delivering in bags, including cartage and getting in, 2s. 8d. During the present disturbed condition of the fuel market, the Company only undertake to execute orders in rotation on the above terms; and preference is given to consumers of gas.—ED. J.G.L.]

The Heating Efficiency of Gas-Circulators.

SIR,—Your correspondents, "Experimenters" state, in their letter under the above heading, that "a circulator when installed in the average house cannot give more than 60 to 70 per cent. working efficiency;" and while I am inclined to agree that this is correct as applied to well-known contrivances, it is certainly worthy of note that very much higher efficiencies may be obtained by the adoption of a simple system which has been strangely neglected by the seekers after economy in gas-heating. The particular apparatus I have in mind, yields well over 90 per cent. of the available gas heat to the apartment—the burnt gas and air mixture being allowed to escape only after it has been reduced to within about 10° of the air in the heated space. I am not aware that any other system has attained to this degree of comparative perfection.



Possibly a short description may interest your readers; and since the system is open for anyone to carry out, other "experimenters" may consider its possible development.

In present form, the plant is applied to heating motor-houses, and consists of a simple "burnt-air" enclosed radiator. Air enters from outside, through a 3-inch pipe at the ground level, and is conducted through an elbow and expanded to 5 inches to the vertical 5-inch combustion chamber rising about 3 feet. At the base of this chamber are fitted two burners controlled by separate taps from outside the combustion chamber, and accessible through a lighting door fitted with glass. At the summit of the combustion chamber, the passage for the burnt gas is contracted to 3 inches through an elbow leading to a 6-feet length of 3-inch cast-iron "downspout," slightly inclined downwards, and running along the inner side of the wall of the house. A double bend and another 6-feet length of piping then conduct the burnt gases to a point very near the base of the combustion chamber; and an elbow finally discharges into the outside air quite close to the point of entrance. If the discharge and entrance apertures are disposed on the face of a flat wall, no back-draughts are to be feared; but assurance may be made doubly sure by the provision of a perforated cover to both openings.

It will be recognized that the system is but another form of syphon-stove; the inlet and outlet being taken direct to the outside air, so that no gas fumes can penetrate into the air of the house. The entire condensation products are discharged at the outlet; and there is nothing to cause or promote their concentration by evaporation.

It must, I think, be obvious that if water circulating systems are to become more efficient, or rather to become of maximum efficiency, they must be designed on principles equivalent to the water-jacketing of the radiator described; the water being allowed to circulate—of course in the opposite direction to that of the burnt gases. In such case, naturally, the vertical combustion chamber should be made of a good non-conductor of heat.

I need scarcely add that six years' experience of this system has failed to show that it possesses any disadvantage that might have been prevented, or that it has not any of the advantages of gas-heating for such purpose. Some years ago I measured the gas supply, observed temperatures, analyzed the burnt gases, and calculated the efficiency to as nearly as I can remember 95 per cent. of the available heat being utilized in heating the house.

I shall be glad to know whether any of your readers have actually ascertained any higher efficiency from gas heating (except, of course, where the products of combustion are not discharged), though one may reasonably doubt such possibility.

J. H. LESTER, M.Sc., F.I.C.

Manchester Chemical Club, March 28, 1912.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read the third time and passed: Leatherhead Gas Bill, Sidmouth Urban District Council Bill, Tendring Hundred Water and Gas Bill.

The Brighton and Hove General Gas Company Bill, Herne Bay Gas Bill, North Middlesex Gas Company Bill, and Ystradfellte Water Bill have been referred to a Select Committee, consisting of the Earl of Camperdown (Chairman), the Marquis of Bath, Viscount Hood, Lord Gwydir, and Lord Monk Bretton; to meet on the 23rd inst.

The Wakefield Gas Bill, Wandsworth, Wimbledon, and Epsom District Gas Bill, Woking District Gas Bill, and York United Gas Bill have been referred to a Select Committee, consisting of Lord Barnard (Chairman), Viscount Falkland, Lord Sempill, Lord Oranmore and Browne, and Lord Brabourne; to meet on the 25th inst.

The Christchurch Gas Bill, Houghton-le-Spring District Gas Bill, and Llanelly Rural District Water Bill have been referred to a Select Committee, consisting of the Earl of Plymouth (Chairman), the Marquis of Bristol, the Earl of Hardwicke, Lord Lovel and Holland, and Lord Seaton; to meet on the 30th inst.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Leatherhead Gas Bill, Sidmouth Urban District Council Bill, Tendring Hundred Water and Gas Bill.

Bill presented and read the first time: Swansea Corporation Bill.

Bills read a second time and committed: Belfast Corporation Bill, Glasgow Boundaries Bill, Glasgow Corporation (Water) Bill, Glasgow Water (Charges) Bill, Staffordshire Potteries Water Bill.

Bills reported: Annfield Plain and District Gas Bill, Dunstable Gas and Water Bill, Egremont Urban District Water Bill, Fleetwood Gas Bill, Windermere District Gas and Water Bill.

The Glasgow Boundaries Bill, Glasgow Corporation (Water) Bill, and Glasgow Water (Charges) Bill have been referred to a Select Committee, consisting of Mr. Mooney (Chairman), Sir G. Pollard, Colonel Rawson, and Mr. Baldwin; to meet on the 16th inst.

The Birmingham Corporation Bill and the Staffordshire Potteries Water Bill have been referred to a Select Committee, consisting of Sir E. Cornwall (Chairman), Viscount Wolmer, Mr. Harris, and Mr. Webb; to meet on the 16th inst.

The Fylde Water Board Bill and the Scunthorpe Urban District Water Bill have been referred to a Select Committee, consisting of Sir Charles Rose (Chairman), Mr. Stanier, Mr. Albert Smith, and Mr. Bird; to meet on the 18th inst.

The Lighting of the House.

Last Wednesday, Mr. Ormsby-Gore asked the hon. member for St. George's-in-the-East (Mr. Benn), as representing the First Commissioner of Works, whether he would give the House an opportunity of discussing the matter before it was decided to replace the gas lighting of the House by electric light; whether he was aware of the opinion of leading oculists that gaslight is less harmful than electric light; and whether gas assists in the proper ventilation of the House. Mr. Benn said an opportunity for discussion would arise when the Vote for the Houses of Parliament was under consideration. The First Commissioner of Works was not aware that leading oculists had expressed any such opinion as that referred to in regard to lights placed as those proposed would be. The reply to the last portion of the question was in the negative. Under the arrangements proposed, the House would be better ventilated than heretofore. Lord Balcarres asked if an undertaking would be given that the lighting should not be altered until it had been ascertained that the majority of the members and officials were satisfied with the proposals. Perhaps the noble lord would say to what he objected. Mr. Ormsby-Gore has given notice of his intention to ask Mr. Benn whether he will appoint a Select Committee to inquire into the question of the best method of lighting the House, before he makes any alteration in the existing system of lighting by gas.

CHEMICAL MANUFACTURERS & GAS RESIDUALS POWERS.

THE ADJUSTMENT OF THE CLAUSE.

Tuesday, March 26.

SOUTH SUBURBAN GAS BILL.

The Committee of the House of Lords who have under consideration the Bill of the South Suburban Gas Company [see "JOURNAL," Vol. CXVII., pp. 815, 906] met this morning for the adjustment of the clause dealing with residual products.

The CHAIRMAN (Lord Ritchie), addressing Mr. Honoratus Lloyd, said that they could not accept either of the proposed clauses handed in by the promoters and Mr. Fitzgerald on behalf of the United Alkali Manufacturers' Association; and they proposed to insert the following clause in the Bill:

> The South Suburban Company (notwithstanding anything in any Act relating to their undertaking or any part thereof) shall not purchase or use in any process of manufacture any materials other than those required for the making and supply of gas by them, or for the working up of their own residual products, or for the construction, maintenance, and repair of their gas-works, or of gas-fittings.

Continuing, the Chairman said that, if it would be convenient, the Committee would be prepared to hear any criticism of the clause, not on the principle, but on its phraseology, after lunch.

When the Committee met in the afternoon,

Mr. HONORATUS LLOYD, K.C., on behalf of the South Suburban Gas Company, said that he had just one or two verbal alterations in the clause to propose. In the first place, he suggested the insertion of the word "for" after the word "purchase;" otherwise he did not think the clause would read properly The clause would then read that the South Suburban Company shall not "purchase 'for,' or use in, &c." Without this word, he thought the Company would be prohibited from buying anything else except the materials referred to; and they would not be able to buy even a typewriter. He also suggested the insertion of the words "plant and buildings" after the words "gas-works" at the end of the clause; otherwise the Company might be prevented from constructing (say) a manager's house or workmen's cottages.

Mr. J. D. FITZGERALD, K.C., for the United Alkali Manufacturers' Association, said he had no objection to the insertion of the words "plant and buildings;" but he did object to the introduction of the word "for," as he thought the clause without this carried out the intention of the Committee, and was correct as it stood. The introduction of the word "for" altered the whole meaning of the clause, in his opinion.

The CHAIRMAN asked Mr. Lloyd if he seriously meant that as the clause stood it would prevent him purchasing anything else in the way he had stated. At the same time, he suggested, as an alternative, to use the words "shall not purchase for any process of manufacture."

Mr. HONORATUS LLOYD said that he thought these words would be satisfactory. In reply to the Chairman's question, he was not prepared to say absolutely that the original wording would prevent him buying such a thing as a typewriter or similar materials; but it laid him open to the possibility of a certain class of person saying that he could not. It might lead to litigation in the Law Courts; and this he wanted to avoid.

The CHAIRMAN said that the Committee would consider Mr. Lloyd's objection, and give their reply on the following day.

Wednesday, March 27.

When the proceedings were resumed this morning,

The CHAIRMAN said that the Committee were not prepared to agree to the insertion of the word "for" in the clause, as they were of opinion that the inclusion of it would affect the interpretation of the remainder of the clause in a sense other than that intended by the Committee. They were also of opinion that the clause without the inclusion of the word "for" would not interfere in any way with the ordinary parliamentary powers of the Company. The clause would therefore read as follows; and, subject to its insertion, the Bill would be allowed to proceed:

The Clause.

> The South Suburban Company (notwithstanding anything in any Act relating to their undertaking or any part thereof) shall not purchase or use in any process of manufacture any materials other than those required for the making and supply of gas by them, or for the working up of their own residual products, or for the construction, maintenance, and repair of their gas-works, plant and buildings, or of gas-fittings.

ANNFIELD PLAIN GAS BILL.—FLEETWOOD GAS BILL.

Tuesday, March 26.

The Committee of the House of Commons who have these two Bills under consideration met this afternoon to consider, first, the form of clause relating to residual products that is to be inserted in the Bills [see "JOURNAL," Vol. CXVII., pp. 818, 907].

Mr. HONORATUS LLOYD, K.C., on behalf of the Annfield Plain Gas Company, informed the Committee that the matter had been under discussion in connection with another Bill in another place. Neither party had, however, succeeded in drafting a clause which satisfied anybody; and the Committee presided over by Lord Ritchie had that morning put forward a clause which they thought met the case. [This clause is given in our report of the South Suburban Gas Bill.] He therefore proposed to put this clause before the Committee, with the two slight alterations which he had suggested in the other House—namely, the insertion of the word "for" after "purchase;" and the words "plant and buildings" after "gas-works" near the end. No objection had been raised to the insertion of the words "plant and buildings;" and the position was the same before this Committee. Objection was, however, taken to the insertion of the word "for;" and, as he had pointed out to the other Committee, he thought its use would prevent possible litigation in the Law Courts in the future.

The CHAIRMAN (Sir Harry Samuel) said they must all be very careful in the matter, because they did not want any decision of the Committee to do the very thing they wished to avoid—namely, give rise to litigation. He hoped, therefore, they would be able to agree upon a form of words which would prevent this.

Mr. C. C. HUTCHINSON, K.C., for the Fleetwood Gas Company, agreed with everything that Mr. Lloyd had said.

Mr. LYNDEN MACASSEY, on behalf of the United Alkali Manufacturers' Association, urged upon the Committee that the clause without the word "for" was perfectly logical and consistent; while the insertion of it would reduce the latter part of the clause to utter nonsense. He was perfectly confident that no Court would hold that a gas company should not buy a typewriter, as Mr. Lloyd had put it, or anything else necessary for carrying on their undertaking. If the word "for" went in, it would leave the gas undertakings free to do what the alkali manufacturers regarded with great disfavour—namely, buy residual products of small gas undertakings and re-sell them. The alteration proposed would limit the purchase of materials to only those required for use in the process of manufacture.

The CHAIRMAN rather disagreed with this point of view; and pointed out the words of the clause relating to residual products. If the promoters and opponents could not agree, he said the Committee must settle the form of words themselves; and with this object in view, he read the following clause, which seemed to the Committee to meet the case:

> The Company shall not purchase the residual products of any gas company, or manufacture chemicals, except for the purpose of working up their own residual products, or of using them in connection with the production or supply of gas and gas-fittings.

Mr. VESEY KNOX, K.C., who appeared with Mr. Lloyd for the Annfield Plain Gas Company, said he was willing to accept this clause.

Mr. HUTCHINSON, for the Fleetwood Gas Company, adopted the same course.

Mr. MACASSEY said that his objection to the clause was that it left out the word "materials" in favour of the words "residual products." He pointed out that while ammoniacal liquor would be a residual product, when concentrated it would not be a residual product; and thus a gas company could deal in it in a concentrated form without coming within the clause.

The CHAIRMAN said the Committee could not agreed to the word "materials" going into the clause, because it went a great deal further than the Committee had any intention of going. Further, a residual product surely was still a residual product, even if it went through fifty stages. If they could not agree as to what was a residual product, then they must leave it to the Courts to decide.

Mr. MACASSEY said a further objection to the clause was that it restricted purchase from gas companies, and would allow a gas company to purchase from a local authority.

The CHAIRMAN said that this was not the intention of the Committee.

Mr. VESEY KNOX and Mr. HUTCHINSON said they were willing to have the words "gas undertakers" substituted for "gas company."

Mr. MACASSEY said that, in his opinion, the clause left it open to gas undertakings to manufacture chemicals.

The CHAIRMAN pointed out that this was so; but only for the purpose of working up their own residual products.

Mr. MACASSEY said that this was not so under the clause originally suggested by the promoters.

The CHAIRMAN, addressing Mr. Macassey, said that it must be realized that both sides could not get all they wanted; and if they could not agree, the Committee must put their own clause in the Bill, leaving it for Mr. Macassey to raise his objections in another place.

Mr. MACASSEY said that, under these circumstances, he would prefer to take the clause put before the Committee by the promoters with the word "for" inserted rather than have the Committee's suggested clause. The vice of this latter was that it gave gas undertakings a power which he was not aware they had before—namely, to manufacture all the chemicals they wanted for the purpose of working up their own residual products; and he had not appreciated that it was the intention of the Committee to allow this. Under the clause suggested by the promoters, this was not so. Could he put Mr. Pearce into the box to give his views upon it?

The CHAIRMAN said he did not think they could do this now. If they could not agree, the Committee would prefer to put in their own clause.

Mr. MACASSEY: I would rather have the first clause with the word "for" inserted.

Mr. VESEY KNOX and Mr. HUTCHINSON both said they would prefer the Committee's clause, unless the first clause was put into the Bill as an agreed clause—thus obviating further opposition to the Bill.

Mr. MACASSEY, after some further argument, said he was willing for the clause to be inserted as an agreed clause for the purposes of this Bill only; but he did not want this to bind the alkali manufacturers in regard to any other Bill. Further, he thought the promoters in the present Bills should give an undertaking that they would not set forces to work outside the Committee rooms which might have the effect of the clause being opposed elsewhere.

Mr. VESEY KNOX said that his friend evidently referred to amendments in the House. Of course, he could not bind every member of the House not to move amendments. At the same time, he would undertake not to set such forces into motion himself.

Mr. HUTCHINSON, for the Fleetwood Bill, concurred; and the clause was added to the two Bills as an agreed clause.

ANNFIELD PLAIN GAS BILL.

The clauses in this Bill were then adjusted, and the Bill reported to the House for third reading.

FLEETWOOD GAS BILL.

Mr. HUTCHINSON put in a new clause dealing with the reserve fund:

> The amount standing to the credit of the reserve fund of the Fleetwood Company under section 17 of the Order of 1884, on the 31st day of December, 1911, shall be limited to the sum of £390; and any other moneys standing to the credit of such reserve fund at such date shall, after the passing of this Act, be carried to the credit of profit and loss and the net revenue account of the limited Company.

This, he said, would enable the difference between £390 and the £2000 which had been put away during the past two years to be dealt with in the reduction of price, or for any other purposes to which the profit and loss account could be applied.

The CHAIRMAN said he did not think this quite met the Committee's views; and although they had not drafted a clause, they felt that the difference between the £390 and the £2000 should be expended on capital account before any additional capital was raised, and should be dealt with as premium capital. It was to be regarded as part of the capital authorized by the Bill to be raised, and upon which no interest should be paid.

Mr. HUTCHINSON said this would be perfectly simple; and a clause to this effect was to be drafted.

The Bill was subsequently ordered to be reported for third reading.

DUNSTABLE GAS AND WATER BILL.

This Bill came last Thursday before the Unopposed Bills Committee of the House of Commons, presided over by Mr. Whitley.

The Bill is promoted by the Dunstable Gas and Water Company, who were incorporated in 1871, and have not been to Parliament since. It seeks sanction to confirm certain unauthorized works which have been constructed, and land which has been acquired, under the powers of their Act of 1871, but which, in consequence of certain decisions during the past few years, it is thought necessary to get confirmed by Parliament. It is also proposed to raise additional capital for the water undertaking to the extent of £15,000, and for the gas undertaking to the extent of £10,000, with the usual one-third borrowing powers. The Company have agreed a new clause with the Dunstable Urban District Council giving a reduction of the water-rates, and have also adopted the suggestion of the Local Government Board to incorporate the Gas-Works Clauses Act of 1871 in the Bill.

The Committee passed the preamble.

BRIGHTON GAS COMPANY & LOCAL TRACTION SCHEMES.

Agreed Protective Clauses.

A Select Committee of the House of Lords, presided over by Lord Newton, have lately been considering a group of Bills coming from Brighton in regard to the supply of electric energy for the purposes of railless traction. Among the opposing petitioners were the Brighton and Hove Gas Company; and the result has been that the following protective clauses have been agreed to.

For the protection of the Brighton and Hove General Gas Company (in this section referred to as "the Gas Company"), the following provisions shall, unless otherwise agreed in writing between the Company and the Gas Company, apply and have effect—that is to say:

(1) The provisions of section 30 of the Tramways Act, 1870, shall, so far as applicable, extend and apply to the reconstruction or the adaptation for electric traction of the tramways, and to the execution of the street work and to any works executed in connection therewith respectively.

(2) The Company shall, in constructing the footbridge forming part of the street work, provide facilities for the Gas Company to carry two steel mains, each of an internal diameter of not less than 14 inches, under the new footway of such footbridge, by means of brackets attached to such footbridge or otherwise (which the Gas Company are hereby authorized at any time to do); and the Gas Company shall be entitled at all reasonable times to have access to the said mains for the purpose of repairing or renewing the same. Any reasonable expenses incurred by the Company in providing such facilities for the Gas Company, and which shall be in excess of the expense which the Company would have been liable to incur under the provisions of this Act or otherwise in dealing with any apparatus of the Gas Company in connection with, or for the purpose of, constructing the street work, shall, so soon as such facilities shall have been provided, be repaid by the Gas Company to the Company. Any question as to whether such expenses have been so in excess as aforesaid, or as to the amount of reasonableness of such expenses, shall be determined by arbitration as hereinafter provided.

(3) Nothing in this Act shall empower the Company or any local authority, company, or person to construct or lay in, under, or over that part of the towing-path of Shoreham Harbour situate between the electricity works of the Mayor, Aldermen, and burgesses of the county borough of Brighton and its junction with the high road leading from Brighton to Shoreham, any electric conduit, wire, rail, or cable for the transmission of electrical energy.

(4) The foregoing provisions of this section shall be in addition to, and not in substitution for or derogation from, any other powers, rights, or privileges, statutory or otherwise, of the Gas Company.

(5) Any dispute or difference which may arise between the Company and the Gas Company, or their respective engineers, touching any of the matters referred to in this section, shall, unless otherwise agreed, be determined by an engineer to be appointed, failing agreement, on the application of either party, by the President of the Institution of Civil Engineers; and, subject as aforesaid, the provisions of the Arbitration Act, 1889, shall apply to any such arbitration.

(6) Section 39 (for the protection of the Brighton and Hove General Gas Company) of the Act of 1903 is hereby repealed.

LEGAL INTELLIGENCE.

CLAIM FOR DAMAGES THROUGH A BURST MAIN.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Tuesday, March 26.

(*Before Mr. Justice* HORRIDGE *and a Common Jury.*)

Stewart v. Metropolitan Water Board.

This was an action brought by Mr. Alfred Philip Stewart, a clothier and outfitter, of No. 96, Essex Road, Islington, to recover damages for injuries to his premises through the bursting of a water-main belonging to the defendants, and alleged to have been caused by the negligence of their servants. Defendants denied responsibility and the alleged negligence.

Mr. A. W. ELKIN and Mr. FANTHORPE (instructed by Mr. Jonas de Meza) appeared for the plaintiff; Mr. CLAVELL SALTER, K.C., and Mr. GOODLAND (instructed by Mr. W. Moon, Solicitor to the Metropolitan Water Board) represented the defendants.

Mr. ELKIN said the plaintiff was a clothier and outfitter in Essex Road, Islington, having a shop and premises which he was bound by his lease to keep in repair. On the night of the 11th of June last year, one of defendants' mains which ran outside plaintiff's premises burst, with the result that it not only threw out a piece of pipe 2 ft. by 3 ft., but the water found its way under the road, burst through the wall of plaintiff's premises, flooded them in the basement, knocked down the party wall, and carried some of his goods into the adjoining premises—many of them into the next street. The consequence was that he was served by the London County Council with notice of a dangerous structure; and the Borough Council also served him with one to repair the drains. He was under liability to make repairs to the extent of £158; while he had lost about £79 in goods. The subject of damages, however, would not arise, as it had been arranged that the question for the Jury should be solely the responsibility of the defendants for the damage caused. What happened pointed to the fact that they had not sufficiently done their duty by inspecting the mains, which he (Counsel) submitted they ought to have done in such a way as to have prevented the accident.

The plaintiff was examined at some length in support of his case; and his manager also gave evidence.

Mr. *H. C. Adams* said he believed the cause of the main bursting was a settlement of the pipe, caused by an erosion of the soil due to running water from a leak which had been going on for years.

In cross-examination, witness said the largest main he had ever laid was a 12-inch one. He found the pressure of water in the main at the point where the fracture occurred was 99·99 feet, whereas that necessary to break the pipe there was 1900 to 2000 feet, which was twenty times the pressure which could exist there. There was no doubt that pipes leaked after they had been laid, and it was extremely difficult to account for it. A pinhole in the iron might start a leak, and the water would erode the soil. This might go on for years.

Mr. SALTER: If your theory of a leak going on for years is correct, how is it that dampness on the walls of a cellar near was only noticed two months before the accident?

Witness: I should say that two months before the accident the pipe was cracked owing to the undermining of the soil by the leakage of the water, and that the crack might be brought about by an extra load on the surface of the road.

At this point the piece of pipe which was blown out by the force of the water was brought into Court; and it seemed to require the united strength of three or four men to bring it in, and place it in front of the solicitors' table.

In answer to other questions, witness said the Water Board's men occasionally went about testing to ascertain if there was any leakage in the distributing system; but there would be more frequent testing of the house fittings. He admitted that there was no instrument which would detect a leakage from a hole 1-16th of an inch; but when the pipe cracked and the leakage increased, it could then be detected. When a leak was discovered, he should test for it with a stethoscope, after cutting off the water.

Re-examined by Mr. ELKIN: The stethoscope simply showed if the water was running. If the main was absolutely isolated and water was found running, it would prove there was a leak.

This closed the plaintiff's case.

Mr. SALTER said the action was an attempt to put the defendants in a position in which they ought not to be placed, and in which they did not stand in law. They had no desire to do anything but what was right, if they were responsible for the accident; and the question for the Jury was whether the Board's servants had been guilty of negligence in laying the pipe or in failing to detect a leak. As to the laying, it happened that in 1909 the main had to be diverted because of the tramways. Some 90 yards were exposed, and it was found to be in such good condition that it was relaid. The Jury had to say whether in fact it had been proved that there had been a leak; and, if so, whether it could have been discovered by ordinary skill and care.

Mr. *J. W. Restler*, M.Inst.C.E., the Deputy Chief Engineer of the Board, said he understood that a suggested theory of the accident was that the main had been subjected to shock. But, as a matter of fact, it was impossible for any shocks due to pumping to reach any portion of the main, or the pipes in connection with it. It was also impossible to close the valves so suddenly as to cause any shock. He had examined the pipe with great care, but found no evidence of leakage, such as plaintiff's expert witness had suggested. He did not agree that the cause of the accident was a leak followed by a burst caused by pressure. He thought the burst and the leakage were coincident. He thought the cause of the accident was expansion. There were two periods of the year, early summer and late autumn, when the temperature of the water changed; and they had found, after many years' experience, that the majority of bursts in the trunk mains coincided

with these changes. The pipes were all jointed together; but they did not expand or contract equally. It was either localized contraction or expansion, exerted on a single joint, which caused bursts.

Cross-examined by Mr. ELKIN: He had always been of opinion that the cause of the burst was localized expansion; and he denied that it was localized contraction. He knew nothing of any official statement issued by the Board as to the cause of the accident.

Mr. ELKIN produced copies of "The Times" and the "Daily Telegraph," which he said contained an official explanation.

Mr. GOODLAND said the defendants had not authorized any statement of the kind.

In further cross-examination, witness said there was no evidence, in his opinion, that the burst of the pipe was caused by subsidence. To test the main properly, if they suspected a leak, they would have had to shut off 60 or 70 main-cocks. If there had been a serious leak, it would have shown on the surface. The Board's men had been using the stethoscope near plaintiff's premises before the accident; but no leak from the main in question had been reported, nor were plaintiff's fittings defective. If it had been reported to the Board that the walls of the cellars near were damp, steps would have been taken at once to ascertain the cause of it.

Mr. *E. M. Eaton*, M.Inst.C.E., said he agreed with the evidence of the last witness, and did not consider that a small leak, such as plaintiff's witnesses had suggested, would account for the burst. There were no instruments known to science by which such a leak could be detected.

Wednesday, March 27.

Mr. *Restler*, in re-examination, produced a number of cardboard records of the pressure on the main on the day the accident occurred. He said if there had been any shock to the main the record would have shown it; but it would not show the difference of supply of a million gallons per day except by a minute trembling of the pencil which made the record.

Mr. *H. R. J. Burstall*, M.Inst.C.E., said he had examined the pipe which burst, and also the piece which blew out. He could find no indication of a small hole or pinhole; nor could he find any crack which might have existed for some weeks, and led to the fracture, which was an exceptionally clean one. He had never known a pipe of this kind, which had been in the ground fifty years, in which a pinhole had caused a fracture.

In cross-examination, witness said he did not agree that the appearance of the pipe showed that it had broken by settlement.

Mr. *Adams* was recalled, and examined by Mr. ELKIN. Dealing with the theory that the burst of the main was caused by expansion, he said the reason mains burst was not known, and all suggestions were theory. As to the theory of localized expansion, in his opinion, there could not be sufficient force in it to account for the burst. A pipe exposed to the air might be liable to burst from expansion; but the one in question was laid 4 ft. 3 in. below the level of the road.

In cross-examination by Mr. SALTER, witness admitted that the cause of these bursts was the subject of anxious and constant discussion among water engineers; and there were, of course, people who thought localized expansion or contraction was the cause.

At the suggestion of his Lordship, Counsel, Jury, and the expert witnesses went down to the hall to inspect the damaged pipe.

Mr. *A. B. Pilling*, the Clerk to the Board, said he was aware that what was called an "official explanation" of the accident had been published, which attributed the burst to local contraction; but no such explanation was issued by the Board.

Counsel having addressed the Jury,

Mr. Justice HORRIDGE summed up. He pointed out that the law had entrusted public bodies like the Metropolitan Water Board with powers to carry water from mains to private houses; and while they had a certain responsibility, they must not be made to pay for that for which they were not answerable. In the present case, they were not responsible for what had occurred, unless the plaintiff could satisfy the Jury that they had exercised their powers without proper care.

The Jury found that the burst was not occasioned by a pre-existing fracture, but by some other cause, and that the defendants could not have been reasonably expected to discover it.

Judgment was given for the defendants with costs. A stay of execution was, however, granted, on the usual terms.

Glasgow Extension Scheme.

On Thursday afternoon, the Commissioners under the Private Bill (Scotland) Legislation Act, who are sitting in Glasgow, announced that the Corporation Order, so far as tramways, city improvements, and gas were concerned, would, subject to adjustment of clauses, be allowed to go through. Under the gas clauses, the Corporation are given power to acquire for gas supply an area of 580 acres in extent within the parish of Mearns. The Council already had 130 of the 580 acres within their area of supply; and for the remaining 480 acres opposition came from the County Council of Renfrew and from the Busby Gas Company, Limited. Evidence in support of the Provisional Order was given by Bailie Paxton, who spoke of the intention of the Corporation to go into the district alluded to, and as to the number of applications they had received asking for a gas supply. Mr. Alex. Wilson, the Manager of the Gas Department, pointed out that the Glasgow main was only 600 yards from the area in question; while the Busby Company's main would require to be extended 1 mile 600 yards. The Busby Company were charging 4s. 7d. per 1000 cubic feet, as against the Glasgow charge in the Mearns district of 2s. 10½d. He denied that the area ever belonged to the Busby Company. In the course of his cross-examination, Mr. Wilson said the Corporation had never entertained a proposal to buy the Busby Company, as it took them too far away from their own area of supply. The Commissioners refused to grant the Renfrew County Council a protective clause in regard to the gas scheme; Mr. Wilson contending that outside authorities had ample protection under the Gas-Works Clauses Act, 1847.

MISCELLANEOUS NEWS.

PRESENTATION TO MR. W. M. MASON.

Congratulations and Good Wishes from his Friends in Scotland.

A large gathering of representatives of the gas profession from all parts of Scotland took place in Glasgow last Tuesday evening, to do honour to Mr. W. M. Mason on the occasion of his departure from Glasgow to take up his duties as Secretary and Organizer to the British Commercial Gas Association. Mr. Mason was the recipient of a handsome Chippendale mahogany writing bureau, suitably inscribed, from his many friends north of the Border.

Bailie PAXTON, the Convener of the Gas Committee of the Glasgow Corporation, who presided, in wishing Mr. Mason every success in the position to which he has been appointed, said he had exceptional opportunities before him in the pioneer work of the British Commercial Gas Association; and as he possessed the tact, energy, and wisdom which were necessary for so important a situation, he believed Mr. Mason would work strenuously for the interests of gas generally, and would bring credit to the city of Glasgow, where he had received his training in gas affairs. So far as the Glasgow Gas Committee were concerned, they were proud in the knowledge that Mr. Mason had been entrusted to fill the important position for which he had been chosen.

Mr. J. MACLEOD (of Greenock), a member of the Council of the Institution of Gas Engineers, mentioned that he had been acquainted with Mr. Mason for many years, and it was gratifying to him to know that the future of the new Association would be, to a great extent, in the hands of so capable and outstanding a man as Mr. Mason. He was sure he had the good wishes of all the Scottish gas industry.

Mr. ALEXANDER WILSON, the Engineer and General Manager of the Corporation Gas Department, in making the presentation to Mr. Mason, said it was pleasing for him to see so representative an assembly of members of the gas profession. He referred to the work which Mr. Mason had done in connection with the inception of the Scottish Junior Gas Association, and expressed the opinion that it was to his untiring efforts at the beginning that its success had been brought about. He had had a long personal association with Mr. Mason, and he found him full of initiative; and in the position to which he had been appointed, where initiative was so much required, Mr. Mason would have plenty of scope for his abilities. In the old days, the gas manager did not trouble much about the sale of gas, and the many appliances now used by consumers for domestic purposes; he was more concerned about his retort-house. However, the outside work of a gas department now required as much attention as the manufacturing side, if not more. Gas suppliers had now to bring their wares before the notice of consumers. There were immense possibilities for extensions in connection with the distribution side of their business; and they did not require to be ashamed of what they had to offer. They had a good article which they sold at a low price. He was of opinion that the gas industry was well advised when they started the British Commercial Gas Association. Though they had not yet been able to get all the gas companies and corporations to contribute to its funds, he was sure Mr. Mason would, in the future, be untiring in his efforts to increase the number of annual subscribers. The splendid results they had had from the Sauchiehall Street show-rooms of the Gas Department were, in a great measure, due to the energy of Mr. Mason; and in his new position his qualifications were sure to lend themselves to the work. He had all their good wishes in his new appointment. It was a personal regret to him (Mr. Wilson) that they were losing Mr. Mason's help in the department; but they were letting a good man go for the benefit of a great industry.

Mr. MASON, in responding, thanked his many friends for their kindness, and for their expressions of goodwill. He said the last nine years had, no doubt, been strenuous ones in his career; and he had tried to do his duty to the Gas Department of the Corporation of Glasgow. He hoped that in his new position he would not fall short of the expectations of his friends. He would ever seek to do his best at all times. He had absolutely no fear in connection with the future of the Publicity movement. The policy of the majority of gas undertakings had been too long of the "take it or leave it" style. Every gas manager knew that this old policy was a thing of the past; and it must be a thing of the past. If they did not run their concerns on good business lines, they would be left behind. It was a cheering element that the Commercial Gas Association was not a charity organization, but a business concern with the motto of "Not what we get but what we give;" and he hoped the gas industry would look to the Association as a centre to defend its interests by aggressive work.

Mr. J. N. MYERS (Saltcoats) mentioned that it was necessary for the industry to have men like Mr. Mason, experienced in the work, to carry on the Publicity movement; and he was sorry that Scotland was losing one who had been such a strenuous worker in bringing the uses of gas prominently before consumers.

Bailie KIRKLAND, the Convener of the Gas-Stoves Committee of the Glasgow Corporation, spoke of Mr. Mason having been practically "pitchforked" into the position of manager of the show-rooms of the Corporation; the Gas Committee having considered him most qualified for the position. His appointment there had proved his worth by the way in which the work of the show-rooms had increased.

Mr. J. W. NAPIER (Alloa) spoke of Mr. Mason's appointment being a great honour to the Gas Department of Glasgow. He said Mr. Mason had the undoubted merit and striking ability necessary for the position of Secretary to the new Association.

Ex-Bailie YOUNG, of Glasgow, also spoke of his association with Mr. Mason in connection with the work of the show-rooms.

Mr. George R. Hislop (Paisley), Mr. Alex. Yuill (Dundee), Mr. Fyfe, the Chief Sanitary Inspector for Glasgow, and others sent letters expressing regret at their absence, and wishing every success to Mr. Mason in his new position.

BRITISH GASLIGHT COMPANY, LIMITED.

A New Issue of Capital.

The Ordinary Half-Yearly Meeting of this Company was held last Wednesday, at the London Offices, No. 11, George Yard, Lombard Street, E.C.—Mr. J. HORSLEY PALMER in the chair.

The SECRETARY (Mr. A. W. Brookes) read the notice convening the meeting, and afterwards the Directors' report, and, in compliance with the Act, the Norwich accounts. The Directors' report was as follows:—

The Directors submit the half-yearly accounts of the Company to Dec. 31 last, as examined and certified by the Auditors, who have also vouched for the correctness of the investments held by the Company.

The available profit is £30,624, after deducting (omitting shillings and pence) the following sums: Income-tax, £2468; Hull debenture interest, £2118; Norwich debenture interest, £1779; Potteries debenture interest, £659; Trowbridge debenture interest, £164; and interest on debenture stock, £2260—total, £9450.

HULL.—The gas-rental shows an increase of £1620, as compared with that of the corresponding period of 1910; the price of gas having been 1s. 10d. per 1000 cubic feet during the six months, as compared with three months at 2s. and three months at 1s. 10d. in 1910. Coke shows an increase of £984; tar, a decrease of £61; tar distilling, an increase of £48; and ammoniacal liquor and sulphate of ammonia, an increase of £235. Coals have cost 12s. 11d. per ton, as against 13s. 1d. Coke has realized 11s. 4d. per ton, as against 10s. 7d. The gas sold shows an increase of 37,245,272 cubic feet, equal to 5·61 per cent. The quantity supplied in bulk to the Corporation for the supply of the old town was 42,165,000 cubic feet; being 905,000 cubic feet less than the quantity supplied in the same period of 1910. The profit realized is £554 in excess of the parliamentary interest. This sum has been invested, making the reserve fund £47,180.

NORWICH.—The gas-rental shows a decrease of £2167, as compared with that of the corresponding period of 1910; the price of gas having been 2s. 10d., as against 3s. per 1000 cubic feet, with reductions for gas used for manufacturing purposes. Coke shows an increase of £854; and tar and ammoniacal liquor, an increase of £846. Coals have cost 16s. 2d. per ton, as against 16s. 3d. Coke has realized 15s. 8d. per ton, against 14s. 4d. The gas sold shows a decrease of 113,900 cubic feet, equal to 0·04 per cent. The profit realized is £520 in excess of the parliamentary interest.

POTTERIES.—The gas-rental shows an increase of £1000, as compared with that of the corresponding period of 1910; the price of gas having been the same—viz., 2s. 6d. per 1000 cubic feet, with special rebates to large consumers and to consumers of gas for power purposes. Residual products show an increase of £611. Coals have cost 10s. 5d. per ton—being the same price as for the corresponding period of 1910; and coke has realized 8s. 8d. per ton, against 8s. 7d. The gas sold shows an increase of 8,372,356 cubic feet, equal to 4·58 per cent. The profit realized, after writing off the sum of £1000 on account of old gasholders now demolished, is £124 in excess of the parliamentary interest. This sum has been invested; making the reserve fund £1397.

TROWBRIDGE.—The gas-rental shows a decrease of £125, as compared with that of the corresponding period of 1910; the price of gas having been the same—viz., 3s. per 1000 cubic feet, with discounts. Residual products show an increase of £154. Coals have cost 15s. 10d. per ton, being the same price as for the corresponding period of 1910; and coke has realized 12s. 4d., against 11s. 9d. per ton. The gas sold shows a decrease of 842,038 cubic feet, equal to 2·23 per cent. The profit realized is £394 in excess of the parliamentary interest.

HOLYWELL.—The gas-rental shows a net increase of £52; residual products an increase of £30. The profit realized is £520.

The available profit added to the previous balance of profit and loss amounts to £101,469. From this sum, the Directors recommend a dividend at the rate of 10 per cent. per annum, with a bonus of 5s. per share, both less income-tax. The dividend and bonus will amount to £28,838, and leave a balance of £72,631.

The CHAIRMAN, in moving the adoption of the report and accounts, said he thought that, with the heavy cloud which was hanging over all industries—and especially the gas industry—the Chairman of even a successful gas company found it difficult to be very cheerful at this moment, though, under ordinary circumstances, the report which had just been read to the shareholders and the accounts which had been circulated were eminently good reading for the proprietors of the Company. They had had not a very large increase in output, but a fair increase, considering the state of business, and considering the state of the gas industry. The increase represented nearly 4 per cent., which, when they took into account the great heat and light which were enjoyed during last summer, and long into the autumn, was, in the opinion of the Board, very satisfactory indeed. The increases were: At Hull, 5·61 per cent.; at the Potteries, 4·58 per cent.; and at Holywell, 3·87 per cent. There were slight decreases only at Norwich and Trowbridge. Now, the accounts spoke for themselves; and he was not going through all the mass of figures which had been put before the shareholders, because there was really no necessity to do so. It showed the exact position of the Company, and the very satisfactory state of affairs, when they were able to continue their usual dividend of 10 per cent., *plus* the bonus of 5s. per share. This result, he thought, must be eminently agreeable to every proprietor. He would just go through a few details with regard to the various matters at the different stations. One of the principal things that he would like to mention was the increase that had occurred at nearly every station in connection with the wages of the men. The Directors recognized during last year that there had been a considerable rise in the cost of the necessaries of life; and this was specially apparent at Hull. They thought it very much better that the Board should be liberal on their own initiative, than that the men should approach them on the subject; and the result was that they had an increase of wages which would cost at least £1700 per annum. The men who were in receipt of the lower scale of wages received a rather larger addition than those earning a higher wage; and it was recognized (and, he thought, in a very admirable way) by the men receiving the higher wages that those earning the lower rate should be treated more liberally. ["Hear, hear."] There was a very interesting social gathering of the men when this announcement was made; and the news was received with great acclamation—the men pledging themselves to deserve the rise in wages to the utmost of their ability. It had, he might say, a very good effect indeed on their employees at Hull. The same thing had occurred at Norwich; and the wage increase at this station would mean an addition of about £800 to the cost of the working there. The Directors had received letters of thanks from the workmen for the consideration shown them. At the Potteries, they were most anxious that the hours of labour should be reduced; and the Directors had introduced eight-hour shifts, which were well received by the men, who had passed a resolution of thanks to the Board. This would also cost the Company about £350 per annum. So much for the increase in wages. Then he came to what might be called "pushing the business." They had had two eminently successful exhibitions—at Hull and at Norwich. He thought he had referred last year to the preparations that were being made to hold the exhibition at Hull. It eventually took place in October, and was open for a fortnight; and it was an immense success. Over 68,000 people attended; and the Company had orders for 400 fires and cookers, while a very large number of fittings were sold. The affair, indeed, created a great deal of interest throughout the whole of Hull. Then at Norwich the Company had a considerable gas exhibit at the Coronation Industrial Exhibition, which was held in the Agricultural Hall, also in the month of October. It was open for three weeks; and the Company secured a very large number of orders for heating appliances of every description. Over 50,000 people visited this exhibition. It was only by embarking upon displays of this kind that the gas industry could be pushed home to every class of consumer; and he was sure the proprietors would appreciate all that the Board had done in this direction during the past half year. In the course of the six months under review, he attended at Norwich a very interesting ceremony—the completion of the Chief Clerk's fiftieth year of service there. It was, he believed, the first occasion on which anybody on the superior staff of the British Gaslight Company had attained fifty years' service. They presented the official concerned with a gold watch; and there was also a dinner, at which he (the Chairman) presided. The Board had further determined to introduce to the workmen at all their stations something which he might describe as of German manufacture. The plan originated, he thought, with the Imperial Continental Gas Association of giving a bonus and also a recognition of 25 years' service in the shape of a medal and a certificate. For a long time the Directors hesitated as to whether English workmen would appreciate such a gift; but after much discussion, they decided to introduce the idea, and so far it had been a great success. The first distribution of these medals and certificates took place at Norwich in February; and the youngest member of the Board of Directors (Mr. L. R. Wilkinson) went down and distributed them, and made many speeches, and endeared himself to the hearts, not only of all the men at the works, but, he believed, of a large number of the citizens of Norwich who were present. This was, of course, rather a novelty to English workmen; but it had been thoroughly appreciated, and the Board proposed to distribute the medals at Hull, at the Potteries, and so on. He hoped himself, as soon as he could find time, to go to Hull and preside on the occasion of the distribution there. The extension of works which he had previously informed the shareholders was to be taken in hand at Hull was progressing very favourably; but it was going to cost a great deal of money. And this brought him to what was really the most important thing he had to mention at the meeting. He had hinted on earlier occasions at fresh capital requirements; and the Directors had now decided that they would need during the next two years at least £50,000 or £60,000, to meet the extensions required at the different stations, but principally at Hull. Therefore they were proposing to issue within the next month 2000 ordinary shares, at a price to the shareholders in the Company of £42 per share. This was giving the shareholders a very good "turn," because he thought he was right in saying that the present price of the shares was between £46 and £47. Certainly, this price was full of dividend; but, under any circumstances, the price with the dividend off would be £45 10s., whereas the new shares, when taken up and paid for in May, would carry the full dividend for the half year up to June 30, which would be payable next October. He had not the smallest doubt that these shares would be readily applied for; and in the course of a few days the letters would be issued asking for subscriptions. Of course, the proprietors would like to hear what the Board had been doing with reference to the strike. The Directors were fully aware that this strike was likely to come, and took means to put into the works—at somewhat heavy cost, he was afraid, in some instances—what they thought would be a sufficient stock of coal to carry them through the strike. When the strike began, at every station they had at least six or seven weeks' supply of coal and oil; and at the present moment, when the strike had been going on for a month, they had still nearly five weeks', and in one instance eight weeks', supplies to carry them on. It had, as he had said, cost the Company something; and this would, of course, appear in the next half-year's accounts. But they had certainly thought it wise to do what they could to keep the public well supplied with light. It was with regret that the Board had to announce that their Manager at the Potteries had been, and was still, very ill; but they hoped he would make a good recovery in course of time. Meanwhile, his Assistant had been doing very well all through this anxious time in connection with the strike. The distress in the Potteries, as he had no doubt the shareholders had read in the papers, was perfectly appalling; and he was quite sure they would agree with what the Directors had done in sending a handsome contribution to the Mayor's relief fund.

Mr. FREDERICK WILKIN seconded the motion.

Mr. BERNARD F. HARRIS, referring to the supply in bulk to the Corporation of Kingston-upon-Hull, asked whether the Company were bound by any contract in case of trouble in connection with the coal supply.

The CHAIRMAN replied that they supplied the Corporation at 1s. 6d. per 1000 cubic feet in bulk; and by their contract they would be obliged to go on doing so as long as they could. They had not hitherto asked any authority to reduce their lighting, except in the two small towns of Trowbridge and Holywell, where the public lighting had been reduced to a slight extent.

The resolution was then carried.

On the proposition of the CHAIRMAN, seconded by Mr. WILKIN, a

dividend was declared of 20s. per share and a bonus of 5s. per share, both less income-tax.

Mr. KENNETH R. MACKAY moved a vote of thanks to the Chairman and Directors. He said that, considering the mild weather they had experienced, the working results from the different stations were most satisfactory. In three instances there had been substantial increases in the output of gas; whereas some large gas companies had suffered a decrease in the past half year.

Mr. GRAHAM WILKIN seconded the proposition; and it was cordially agreed to.

The CHAIRMAN, in acknowledgment, said they were working in very strenuous times, and a great deal of responsibility attached to directors of gas companies. He and his colleagues on the Board, hoped, however, to meet the shareholders in six months' time with a happier prospect in view as regarded strikes and labour troubles, which he sincerely trusted would soon be at an end. Before resuming his seat, he wished to move that the thanks of the meeting be given to the Secretary and officers of the Company. During the past six months, every employee of the Company had worked nobly. They had all gone through very hard times—especially the Managers, Secretary, and office staff—and had done a great deal of extra work.

Mr. CORBET WOODALL remarked that he was particularly glad to have an opportunity of seconding the resolution, though he had little to add to what the Chairman had said. There was no doubt that the trying times through which they were passing had put upon the Secretary and upon the officers at the works a very large amount of additional labour. One satisfactory thing about it was that they had all of them proved so well equal to the strain. They were under considerable obligation to Mr. Brookes for the manner in which he had watched the accumulation of stores, and seen that they had not gone lower than was absolutely necessary. The gas industry, it appeared, had suffered less than most from the extraordinary position in which the labour market now was. If it should happen that the Company's stores did not last out the period of the strike, he thought they would have little to reproach themselves for; but he could not believe that this would occur. He felt sure that the sense of patriotism and human sympathy was no more wanting on the part of the miners than on that of the employers, and that a way out of the difficulty would be found before long. He thought that the trouble which had occurred was largely due to that sad and melancholy blunder, the passing of the Miners' Eight Hours Act; and it might be that one good thing would come out of it—the rescission of this most unfortunate measure. Meanwhile, he was sure that, if any further trouble came to the Company—which he did not for a moment expect—they would at least have had every possible help from the officers to postpone it to the latest date.

The vote was heartily carried, and briefly acknowledged by the SECRETARY.

SAN PAULO GAS COMPANY.

Large Increases in Gross and Net Receipts.

The Annual General Meeting of the Company was held last Thursday, at Winchester House, Old Broad Street, E.C.—Mr. D. M. FOX in the chair.

The SECRETARY (Mr. G. H. Rogers) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said he was sure the shareholders must all have been pleased to receive such a highly gratifying report and statement of accounts, setting forth clearly and explicitly the results of the past year's working, and the financial position of the Company at the close of the year 1911. However eventful the year might have been at home, and in most parts of the world, it had certainly been a year of unchequered prosperity to the State and City of San Paulo, in which good fortune the Company had fully participated. He heartily congratulated the shareholders on this satisfactory state of affairs; and he ventured to assure them that the future prospects appeared to be no less favourable. After all, these record results had only been on a par with the rapid development of the City where it was the Company's privilege to be located; and as it was quite certain that, for years to come, the State and City of San Paulo must continue to advance in wealth, and in residential and industrial importance, so the Company might reasonably expect to share in the general prosperity. Projects were on foot to erect handsome buildings, open up public squares and parks, and in general to carry out sweeping improvements in the central area of the city itself. During the past year, it was stated, some 4000 new dwelling-houses had been erected, and the price of land and house property in the city and suburbs had risen immensely in value. "King" Coffee—the staple export of the State—of course, was the basis of this prosperity; the price having reached a very high figure. Business in general during the year had been quite good, and money was plentiful. Exchange had been steady throughout the year at a little over 16d. per milreis; and consequently the price of gas in currency had been fairly constant—an advantage alike to the consumer and the Company. The charging-out price of coal was about 7 per cent. higher than in 1910 The sales of coke and breeze had been very good; the demand having exceeded the supply, in spite of a considerable increase in price. Tar also sold fairly well. The competition of electricity, of course, had to be reckoned with, especially in the centre of the city. In some of the wide Avenidas and principal streets where central lighting was required, a preference seemed, at present at any rate, to be given to electricity, and gas for the sides of the streets. The Company enjoyed a good reputation among private consumers (who appreciated the efforts of the administration to meet their wants), and continued to be on the best of terms with the Government and the Camara Municipal, and their officials. The installation of high-pressure lighting on the Keith system, inaugurated for the first time in San Paulo in the environs of the magnificent New Municipal Theatre, had given great satisfaction to the authorities and to the public generally, and was an excellent advertisement of the capabilities of gas lighting under modern conditions. The chief feature of the past year's results was, however, the steady increase in the make and consumption of gas for all purposes; and it would, he thought, interest the shareholders if he gave a few figures. The total amount of gas delivered for consumption was 14,007,200 cubic metres, or about 495 million cubic feet—an average of about 1,355,000 cubic feet per day. This constituted quite a record; being 77 million cubic feet more than in 1910—an increase of about 18 per cent. The gas sold was equivalent to about 88 per cent. of the total delivered for consumption. Public lighting amounted to 85 million cubic feet—an increase of 6¼ millions over 1910; while private consumption for lighting and other purposes was (say) 348 million cubic feet—an increase of 69 millions, or nearly 25 per cent. as compared with 15 per cent. increase in 1910. It was an interesting fact that the consumption for stoves and engines alone exceeded that of the public lamps by 32½ million cubic feet or about 38 per cent. The use of gas for cooking and heating purposes was being adopted by all classes; and it was obvious that, should the present rate of development of the city continue, they would have to provide for an even larger consumption in the near future. With regard to the manufacture of gas, the carbonizing results showed a decided improvement over those for 1910. The yield of gas per ton of coal carbonized was 11,354 cubic feet, as compared with 11,034 cubic feet in the previous year. The sales of residuals realized 61 per cent. of the cost of coal carbonized—exactly the same ratio as in 1910. Turning attention to the accounts showing the financial results of the working, it would be noted with satisfaction that the revenue account showed that an increase was recorded in every item of the receipts. The shareholders would not expect him to go into further details, as the figures spoke for themselves. Regarding the expenditure, the shareholders would not be surprised to find that coal and oil showed an increase of £18,396. Public lighting expenses were naturally higher with the larger number of lamps in use; and the strict attention that had been paid to repairs and upkeep, as well as the items of expenditure affected by the general increase of the business, called for no special mention. The total gross receipts for the year, as shown in the revenue account, amounted to £248,265; being an increase of £44,895, or (say) 22 per cent. The working expenses, including London charges, were £180,566—an increase of £23,396, or (say) 15 per cent. The net profit, amounting to £67,699, showed an increase of £21,499, equal to 46 per cent. over the previous year. Adding to this the dividends on investments (£833), and the balance brought in from 1910 (£7391), the total to be dealt with was £75,924. Deducting the charges for service of debentures, dividends on preferred and ordinary shares, and other items set forth in the second paragraph of the report—amounting to £34,378—there remained a disposable balance of £41,546—an increase of £14,654. The Directors having placed to general reserve account £10,000, and appropriated £5000 for the improvement of the public lamps, had now the pleasure of recommending the payment of a final dividend of 6 per cent.—making, with the interim dividend of 6 per cent. paid in October, 12 per cent. for the year, free of income-tax, and leaving £11,546 to be carried forward to the next account, or £4154 more than was brought in. Turning to the balance-sheet, it would be noted that the figures amply proved the strength of the financial position of the Company. The capital expenditure during the year was £35,898, of which about £20,000 had been spent on new mains, lamps, meters, &c., and about £15,000 on sundry additions to works and plant. The shareholders would not be surprised to find the item "Stock of Coals," &c., unusually large—nearly £19,000 in excess of last year—in view of the disastrous state of the coal trade. Acting on the advice of their shrewd Managing-Director (Mr. A. F. Phillips), the Board "took time by the forelock," and fortunately they had in hand, and at relatively reasonable prices, such a stock of coal as ensured them against risk of shortage. The other items of the assets called for no special comment; but he should tell the shareholders that the actual value of the real estate in San Paulo far exceeded the figures at which it appeared in the balance-sheet. On the other side of the balance-sheet, it would be found that the capital had been increased by the issue of 3500 6 per cent. preference shares of £10 each—being the balance authorized—partially paid (£5), and by 5000 ordinary shares of £5 each partially paid (£3). These new shares, preference and ordinary, were all fully-paid on Jan. 30 this year, and would rank for dividend with the old shares, preference and ordinary, as from Jan. 1, 1912. The reserves, being the undivided net profit, now stood at a substantial figure; and, after the transfer of £10,000 from the past year's profits, would exceed £113,000. The other items on the debtor side required no explanation, beyond saying that the "Loan from Bankers" were paid off after the receipt of the final calls on the new capital. Before he concluded, might he be allowed to refer to the declaration he made from the chair at the extraordinary meeting on July 7 last year. Shareholders would remember that they were then told that, "barring unforeseen contingencies," they might count on receiving dividends for the then current year of 12 per cent., free of income-tax, and that this would be the "normal dividend of the future." The first part of this promise had been amply fulfilled, and in addition the reserves had been substantially strengthened, and the carry-forward materially increased. With regard to prospects, the shareholders would be pleased to hear that the present year had begun well; the profits in San Paulo received by cable for January and February being £1800 more than in 1911. But, he was afraid, they must count upon a considerable and unknown increase in the cost of coal and oil, owing not only to higher freights, but to the disastrous effects of the industrial dispute now paralyzing the trade of this country. However, this need not in the least disconcert the shareholders, or prevent them looking forward with confidence to a continuance of advancing prosperity in the State of San Paulo, which nothing short of a catastrophe would impede. Finally, they must remember their indebtedness to the zeal and business ability of their Manager in San Paulo (Mr. Norman Biddell), who, with the Engineer (Mr. Whyte), continued to render excellent service to the Company. He should have much pleasure in proposing a hearty vote of thanks (which he trusted some shareholder would second) to the officers and staff in San Paulo, and include the staff in London. They had an excellent Secretary, as those who had met him knew full well.

Mr. A. F. PHILLIPS seconded the motion.

Mr. C. Cross congratulated the Directors on the excellent report. He was glad to find the stock of coal was so satisfactory; but there was one question he should like to ask in regard to it. Supposing the coal in this country became too dear, would the Directors be able to obtain coal from any other source?

Mr. A. F. Phillips said the Company had other sources from which to obtain coal; and they were, in fact, obtaining coal at the present time (besides England) from America.

The motion was unanimously carried.

Proposed by the Chairman, and seconded by Mr. Phillips, dividends were declared at the rate of 6 per cent. per annum, less income-tax, on the preference shares, and 6 per cent. on the ordinary shares (making 12 per cent. for the year on the latter), free of income-tax.

The Chairman moved a vote of thanks to the officers and staff in San Paulo and London, speaking highly of their vigilance and zealous work in the interests of the Company.

Mr. C. B. O. Clarke seconded the motion; and it was carried.

Proposed by Mr. Clarke, and seconded by Mr. A. E. Phillips, a cordial vote of thanks was passed to the Chairman and Directors.

BRITISH COALITE COMPANY, LIMITED.

The Adjourned Ordinary General Meeting of this Company was held last Wednesday, at River Plate House, Finsbury Circus, E.C.—Mr. James Todd presiding.

The Secretary (Mr. Acton Phillips) having read the notice convening the meeting and the report of the Auditors,

The Company's Position.

The Chairman said he greatly regretted that the year's accounts were not more satisfactory. Indeed, a worse showing could not well be made. The accounts formed an indisputable record, in summary, of how the Company's money had been dissipated. There had been transferred to a suspense account the expenditure upon buildings, fixed machinery, furniture, and fixtures, amounting to £218,591; there being no assets representing this expenditure. Part of this had been necessitated by the disposal of the Hythe and Plymouth plants; and the balance arose from the reduction of the remaining assets to what was believed to be a fair estimate of their value. The condition of the Company might be stated as follows: The value of all assets, including the Wednesfield and Barking properties, but excluding any value for patents, was £198,350, subject to £75,000 of 5 per cent. debentures, £8332 for special lien creditors (in respect of advances to pay debenture interest and maintain operations), and £7303 for trade liabilities, which together amounted to £90,635; showing an apparent surplus of £107,715, or roughly 2s. 6d. per share on the ordinary capital. Under a forced sale, however, probably little would be produced in excess of the mortgage lien. The result of the conduct of the business was simply appalling. There had been spent for plant, buildings, &c., now in suspense account £218,591; formation expenses, £85,809; discount and cost of issuing debentures, £13,190 (equal to 17½ per cent. of the principal sum received); and loss on operations, £126,905—making together £444,496. To this, if the apparent surplus was not realized, must be added £107,715; making the total amount of share capital lost £552,212.

The Eticoal Syndicate.

With Mr. Francis Bryce and Mr. Herman Clarke (the Managing-Director) he declined to accept any responsibility for these conditions. Mr. Bryce and he joined the Board in the middle of 1910, and, with Mr. Clarke, had since been engaged in cutting-down expenditure on liabilities previously incurred. They had received neither Directors' fees nor travelling expenses, and they had advanced £2921 to pay interest on the debentures to prevent foreclosure, and had also advanced £1875 to pay pressing obligations of the Company prior to the registration of the Eticoal Syndicate, which had not yet been repaid. If the Syndicate proved successful, this Company would share the profits equally, and there would have to be a drastic writing-down of capital, so as to harmonize figures with facts. The administration expenses would be very small after the 30th of September next. The general expenditure account showed that the loss on operations during the past year was £19,145 less than that of the previous year; and the reduction would have been much greater but for the fact that many of the economies instituted did not become operative until after the end of the financial year, inasmuch as many officials, technical experts, and service obligations were under contracts which could only be cancelled by long notices or lump-sum payments, entailing heavy expense. The accounts for the current year would, in this respect, show a great improvement upon 1910-11; though it was only within the past few months that the Directors had been able to reduce expenses to what might be considered reasonable. Not one of the Directors (including the Managing-Director) was drawing any remuneration. The total expenses of the Company did not now exceed £1000 per annum; and after Sept. 30 he anticipated that they would not amount to half this sum. At the adjourned annual meeting, held on July 5 last, a shareholder suggested that the the Directors should file a petition for winding-up the Company; but this was strongly opposed by the Chairman, who was supported in his views by a large majority of the shareholders. He (Mr. Todd) did not think the Company had sustained any loss by the decision; on the contrary, he felt that a wise conclusion was arrived at. Therefore, as the spokesman of the Board, and as a shareholder, he ventured to submit the conviction that it was in the interest of all of them to await the results of the operations of the Eticoal Syndicate, earnestly hoping for its success. He moved the adoption of the report and accounts.

Explanatory Statement by the Managing-Director.

Mr. Herman Clarke, who seconded the motion, said he wished to explain the circumstances which had brought about the formation of the Eticoal Syndicate. When the debenture issue was settled, application was made by the Company for £300,000, which the Investment Registry agreed to advance. Pending the preparation of the documents, the Registry advanced a sum equivalent to between £60,000 and £65,000, which was to be used to pay off obligations of the Company. While the papers were being drawn, he became Managing-Director. On looking into matters, he found that a great many of the statements which had been made as to results were erroneous; and when this position was laid before the Registry, they refused to make the loan, and demanded repayment of what they had already advanced. In carrying out negotiations arising from this situation, agreements were entered into whereby the mortgage-holders agreed to permit the Company to endeavour to develop a process which might be commercially successful, provided, among other things, that the debenture interest was deposited six months in advance of the due date, and that all expenses for the carrying out of such experiments were paid for without using the assets of the Company. Certain experiments were accordingly carried out at Barking, with results which warranted the belief that, given further capital, the Company might be rehabilitated. In July, 1911, the experiments had reached such a stage that certain financial interests in the City agreed to furnish the money to provide the debenture interest in advance and to carry on operations, provided that, in the event of success being achieved, they were given a preferential position with regard to the Coalite Company. The idea put forward by these financial groups was so drastic that the Directors declined to agree to it; and the final result was the formation of the Eticoal Syndicate, to carry out a further test on a larger scale. The Syndicate acquired half the rights of the Company; and it was a better position than the Board had any reason to expect they would secure. The Syndicate had taken over the operation of the plant at Barking, where the work was being carried on under the supervision of Messrs. W. B. Peat and Co., chartered accountants. From September up to the middle of January, when the coal strike became imminent, operations were conducted at a profit. It was demonstrated that the fuel could be made to more than pay for the coal; they had delivered rather over 60 per cent. of the coal to their customers, as against 40 per cent. under the old method; and it was shown that, with properly constructed plant operating on a commercial scale, there was strong reason to believe that more than the profit anticipated in the prospectus could be realized. There was no question in his mind that, with sufficient capital, the Company could be rehabilitated and the shares made valuable. Under certain conditions, the Eticoal Syndicate had agreed to provide the wherewithal to retire the existing obligation of £75,000 and replace it by a consolidated mortgage, and to furnish sufficient capital to erect plants throughout England, so as to put the business on a commercial foundation and earn dividends. The speaker added, in reply to questions, that the financial groups with whom they were working were able to command unlimited capital; and that the Barking property was valued at £145,000 in July, 1910.

The motion was carried unanimously.

It was proposed and seconded that Mr. Thomas Parker, one of the retiring Directors, should be re-elected; Sir William Preece, who also retired, not offering himself for re-election.

WELLINGTON (N.Z.) GAS COMPANY, LIMITED.

In the "Journal" for the 19th ult. (p. 812), it was mentioned that the above-named Company had a balance of £30,536 to go to the profit and loss account as the result of the working in the year ended the 31st of December. In moving the adoption of the Directors' report at the recent annual meeting, the Chairman (Mr. D. Nathan) congratulated the shareholders on being able to state that the year 1911 had been a satisfactory one to the Company. Owing to the existing works being pressed in the winter to their full productive capacity, no very special attempt had been made to push the business; but, nevertheless, the increase in the gas sales had been satisfactory, amounting to 5⅜ per cent. The quantity of gas manufactured was 324,488,000 cubic feet, of which the heaviest day's make was 1,204,000 cubic feet. The number of new connections made was 717; while 560 chains of new mains had been laid The policy of the Directors' in encouraging the use of gas for cooking had again been successful—732 stoves having been fixed. As he pointed out at the meeting last year, the Directors had decided to erect new works at Miramar, and adopt vertical retorts having a capacity, in the present instalment, of 750,000 cubic feet of gas per day. In order to find part of the money required for the new works, and to pay off the £50,000 debentures falling due on the 15th of June next, the shareholders sanctioned, in August last, the issue of 75,000 preference shares of £1 each. These were offered to the shareholders, and 69,781 shares had been allotted; producing a small premium on shares tendered for in excess of those to which individual holders were entitled. The shareholders would be pleased to learn that 36 employees of the Company applied for, and were allotted, 1441 preference shares; and, on a comparison of the present and last year's balance-sheet, it would be noticed that the number of fully-paid £10 shares had been increased by 175 shares, due to the completion of the payments by employees on the shares to which they were contributing by weekly or monthly payments. The Directors were satisfied that it was to the interest of the Company that as many of the employees as possible should be encouraged to become shareholders. The half-yearly dividend on the ordinary shares which the Directors recommended would absorb £9270 of the £30,536 standing to the credit of the profit and loss account; leaving £21,266 to be carried forward.

The motion having been seconded, Mr. G. M. Kebbell compared the working of the Company with that of the Napier Gas Company, and pointed out that this Company charged 5s. per 1000 cubic feet, and paid a dividend of 15 per cent., while the Wellington Company charged 5s. 5d. and paid a dividend of 10 per cent. He said he could not understand the great difference between the results of the two Companies' working. The Chairman remarked that, without having before him some of the figures to which Mr. Kebbell had referred, he could not deal with his criticisms. He could say, however, that the management of the Wellington Gas-Works would compare favourably with that of any gas-works in the Colonies. The policy which had been pursued would leave the Company owing nothing on an undertaking that had cost something like £400,000. He assured the shareholders that their property and interests were thoroughly well looked after.

The report and accounts were adopted.

CONFERENCE ON SMOKE ABATEMENT.

The Papers and Discussions in Connection with the Agricultural Hall Exhibition.

A three-days' conference was held on Tuesday, Wednesday, and Thursday of last week, at which a number of papers were submitted. The communications were divided up into three sections, to each of which a day was devoted—Smoke Pollution; Smoke Abatement; Law and Legislation.

Some Announcements.

At the opening of the proceedings on Tuesday morning, there was a good attendance of delegates. The chair was taken by Mr. W. Whitaker, who, before calling upon the reader of the first paper, said the Secretary (Mr. Lawrence W. Chubb) had some announcements to make. In the first place, the Secretary apologized for the absence of the Hon. Secretary (Dr. R. Lessing), in consequence of his recent marriage. Proceeding, he stated that there would be 71 authorities represented at the conference. Both the Exhibition Council and the Coal Smoke Abatement Society were exceedingly gratified to know that this set of conferences would undoubtedly be attended by the largest number of delegates from municipalities that had ever taken part in gatherings on this important subject. In addition to delegates from numerous Metropolitan Borough Councils and the London County Council, they extended a warm welcome to the representatives from numerous foreign municipalities. In addition, there were official representatives from the Swedish Government and the Minister of Commerce at Amsterdam; while there were even delegates attending from America. In view of the great difficulty that it was feared would necessarily (in consequence of the coal strike) follow any effort to arrange a pleasure programme, it was at first decided to omit this; but the Committee were informed that, especially the foreign visitors, would be much disappointed if something of the kind was not done, and so at short notice a few visits had been arranged. One would be, on Wednesday afternoon, to the Beckton works of the Gaslight and Coke Company—a hearty invitation to take part in which had been received from the Company. Parties would also be welcomed at the Chelsea electricity generating station of the Underground Railways and the Greenwich electricity station of the London County Council.

Effects of Coal Smoke on Buildings.

The first five papers on the *agenda* were taken together, inasmuch as two of them dealt with the effect of coal smoke on buildings, one with the influence of smoke on decorations, the fourth (by Dr. Samuel Rideal) with the effects of town air on metal work, and the fifth with smoke and fog. Sir Arthur Church, K.C.V.O., D.Sc., concluded his notes on the action of coal smoke on building stones and mural paintings by uttering one caution—namely, that "abatement of the smoke nuisance, or even its entire abolition, however great the advantages to health and comfort, and the amenities of life which it will bring, cannot get rid of the injury and pollution caused by sulphuric acid." Mr. Noel Heaton, also, in his treatment of the question of the influence of smoke on decorations, pointed out that smoke must not be blamed for everything; and it must be realized that if all smoke were entirely abolished, the amount of sulphuric acid discharged into the air would be just as great, so long as coal combustion continued, and also that the impurities in the air of great cities not due to fuel at all would be just as great. The point which thoroughly justified the agitation in favour of smoke prevention, however, was that, in the absence of smoke, the effect of the presence of these impurities in the air would be minimized. In the third paper, Mr. Harry Redfern gave further particulars as to the effect of coal smoke on buildings.

Gas versus Coal and Coke.

Dr. Rideal took for his subject the effect of town air on metal work; and, in introducing the paper, he remarked that this, though at first sight apparently a minor point, was really a most important matter in connection with the action of coal smoke. Of course, it was not the black coal smoke that was the injurious constituent of the atmosphere, but the associated sulphur compounds, which were inevitably produced when coal was used for fuel purposes. An attempt was made to deal with this matter by legislation in the early days of the gas industry; and the gas undertakings generally were subjected to what were termed the "sulphur clauses" until quite a few years ago, when the step was taken of abolishing them in numerous instances. He might say that he was one of those who were instrumental in securing the abolition of these clauses, which might at first sight appear to be somewhat of a retrograde step. But it must be recollected that neither coal nor coke had ever been subjected to the sulphur clauses; and so it was rather unfair that gas should be under this burden of removing sulphur. The sulphur clauses, however, were confined to the total sulphur in gas other than sulphuretted hydrogen; and in the process of gas manufacture and the subsequent operations the sulphuretted hydrogen had always been removed, and was so at the present time. Thus the abolition of the sulphur clauses as applied to gas undertakings did not mean the abolition of the removal of the sulphuretted hydrogen. Gas was superior to coal or to coke in this respect, inasmuch as the sulphuretted hydrogen had always been removed from it. Coal invariably contained a considerable quantity of sulphur; and if the coal was converted into gas, and the sulphuretted hydrogen was removed, then a portion of the sulphur was taken away from the fuel supply—which portion was not removed from coke or coal. The quantity of sulphuretted hydrogen produced by the destructive distillation of coal in retorts represented roughly nine-tenths of the total sulphur; so that in the process of gas manufacture 90 per cent. of the sulphur present in the coal was removed. If, therefore, they could abolish the use of coke and coal, and rely solely upon the gas supply, they would be removing 90 per cent. of the sulphur impurity which they were discussing that day. This would be a very great step towards doing away with the effect of the sulphur acids upon building stone and metals.

In the course of his paper, he said sulphuretted hydrogen requires special attention as the only ordinary gas which attacks silver; and apart from the expense of continually cleaning with whitening or other polishing agent, there is a constant loss of the precious metal in the removal of the film of silver sulphide—a loss that might be calculated from the gradual thinning and reduction of weight of silver articles in course of time, and would amount to a very serious aggregate. Aluminium is unaffected by sulphuretted hydrogen; but copper and brass are particularly sensitive to attack by it. Ammonia, also present in small quantity in the air of towns, can attack copper or brass. After quoting some analyses of soot, he said it had been calculated that coal smoke alone produces annually in the British Isles about 3,000,000 tons of sulphuric acid, most of which is showered down in the rain.

Dr. Rideal then dealt with the serious results arising from atmospheric corrosion of metals, and cited some of the means that have been adopted with a view to remedying or retarding the action of town air in this respect. He concluded by remarking that of recent years there has been much improvement in the conditions, owing to the work of Smoke Abatement Societies, and to the introduction of smokeless lighting by incandescent burners and by electricity, and of heating by gas-stoves instead of coal-fires. "We must," he added, "remember that in the present purification of gas, 90 per cent. of the sulphur in the coal is removed, and the methods of burning eliminate the evils of smoke and soot, which we have shown to have pre-eminently the most injurious effect on metals."

In the course of the subsequent discussion on the papers, Mr. Walter Reid said he did not suppose they would ever get to the stage of prohibiting the use of coal; but gas might be made at the mines, and electricity brought into the towns. This would be even better than producing gas as now. Bailie W. B. Smith (Glasgow) remarked that the title of the Society limited them to considering the effect on air of smoke alone; and he suggested the adoption of some such words as "Air Purification." In the course of his reply, Dr. Rideal pointed out that chemicals were manufactured from the sulphur which was taken out in the course of gas making; so it was obvious that if they could succeed in removing the sulphur from coke and coal it would result in economy in the supply of these articles.

Sunshine Records—Smoke and Vegetation.

The afternoon session, over which Sir William Ramsay, K.C.B., presided, was occupied with the reading and discussion of the following papers: "Sunshine Records," by Mr. R. G. K. Lempfert, M.A., Superintendent of the Forecast Division of the Meteorological Office; "Recent Observations of the Smoke Nuisance at Kew Gardens," by Mr. W. J. Bean, the Assistant-Curator at the Kew Royal Botanic Gardens; "Effect of Smoke on Vegetation," by Miss Agar, the Landscape Gardener to the Metropolitan Public Gardens Association; and "Air Pollution by Coal Smoke and Its Effects on Vegetation," by Mr. Arthur G. Ruston, B.A., B.Sc., of the Department of Agriculture at the Leeds University.

During the discussion, Councillor William Muirhead (Liverpool) expressed the hope that, in the matter of smoke, they would not try to prove too much, as there were other factors in town life besides this which were detrimental to vegetation. Mr. Ruston contended that the manufacturers were the greatest offenders, not because they turned out more smoke than householders, but because in the case of a factory chimney they were getting the soot pollution in a more concentrated mass. Sulphur fumes present to a small extent would have little effect on vegetation; but if they were concentrated within a small area, the result would be more serious. Sir William Ramsay remarked that one thing they were perfectly agreed upon was that the chief sinners in the way of causing the absence of ultra-violet light were the producers of smoke.

Wednesday's Proceedings.

At the morning sitting on Wednesday, Sir William B. Richmond presided; and, in opening the proceedings, he especially gave a hearty welcome to the delegates from abroad. He also briefly outlined the successful progress of the work of the Smoke Abatement Society.

Work Abroad.

The first paper was by Herr Nies, who is the Engineer of the Hamburg Smoke Abatement Society. The paper dealt with the inspection of factories in Hamburg; and in the course of it, reference was made to the work that is being done through the Society there in educating stokers, and in undertaking the investigation of the chemical and calorimetric values of coal. The necessity of duly proportioning air supply to ensure complete combustion of fuels was emphasized. The next paper was by Mr. Thomas E. Donnelly, the Chairman of the Smoke Abatement Commission of Chicago; and he dwelt upon the question of "Smoke Abatement in America," also explaining what is done in the matter of factory inspection. The Chief Inspector of Chicago believes that, in the last three years, as the direct result of the work, the smoke in the city has been reduced one-third. He believes that the abatement of smoke is not a matter so much for legislation, as for engineering and administration. In the succeeding paper (which was taken as read), Mr. Z. A. Willard, of Boston, U.S.A., also treated of the "Smoke Problem in the United States." As an illustration of the damage caused, he stated that it was estimated by the principal merchants of the city of Chicago that in 1909, £8,000,000 would hardly cover the loss, not including injury to private property. The remedies recommended are gas fuel, coke, or briquettes, and electricity obtained cheaply from public plants.

Gas-Fires as Smoke Preventers.

Bailie W. Smith, the Chairman of the Air Purification Sub-Committee of the Glasgow Corporation, contributed the next paper, in which he advocated strongly the use of gas-fires. In the course of

the paper, he said: In the City of Glasgow, in winter time, chemical analysis of the air shows that over three-fourths of the atmospheric impurities come from coal burned in the domestic fireplace or kitchener, including, of course, open fires and stoves used in shops, warehouses, and offices; and therefore such fires are mainly responsible for any fogs that occur. And these fogs are more deadly because the products of combustion from domestic fires contain a much larger proportion of oily tars than are produced in most factory furnaces, where the coal is burned at higher temperatures.

Fortunately, to-day we are able to supersede the old-fashioned domestic coal-fire by appliances which are smokeless; and all citizens should consider what they individually can do in their own houses and offices. The method available by the greatest number of the inhabitants to-day is undoubtedly the use of gas for heating and cooking purposes. The improvements in the various appliances for using gas have been so great within the last few years that the objections which formerly could be reasonably urged against the use of gas have been removed.

About three years ago, the Glasgow Corporation instructed their Chief Chemist to make a research into the whole question of warming houses by gas; and, after about a year's work, he issued a most comprehensive and exhaustive report, which proved absolutely that gas-heated rooms are perfectly healthy and pleasant to live in.* He demonstrated that the objection that used to be urged against gas-fires, that they dried the air of a room, did not hold good with modern forms of gas-fires, which give out the heat by radiation alone, and not by convection, as in the earlier forms of gas fires or stoves; and that with these modern gas-grates the humidity of the air in a room is practically the same as it is in a room heated by a coal-fire. His elaborate and delicate analysis of the air in rooms heated by gas-fires showed that, with properly constructed fires, such as are now universal, no trace whatever of impurity from combustion got into the air of the room. Analyzing the products of combustion that were carried up the chimney, he found that those from the coal-fire, in addition to the soot and tarry matter, contained about ten times more gaseous impurities than the products of combustion from the gas-fire—the carbon monoxide and sulphurous acid being about ten times as great from the coal-fire as from the gas-fire.

As regards cost, he found that with gas at 2s. per 1000 cubic feet and coal at 10½d. per cwt., for warming a room during a whole day, gas was about 30 per cent. dearer than coal, without reckoning anything for the indirect expenses of labour, cleaning, &c., caused by the use of coal; but that for warming a room for a few hours at a time, such as morning or evening, the gas was not dearer than coal. If, however, we take into account all the incidental expenses connected with the use of coal—the labour and inconvenience involved in getting the coal into the cellar and from the cellar to the room, in getting rid of the ashes, and in cleaning the grates and flues and sweeping the chimney, together with the extra cleaning of the room itself and of the curtains and furniture, the difference in cost (if any) cannot amount to much. The convenience alone ought to compensate for any difference in cost.

People who nowadays have their water supply led into their houses, and can get all they want by simply turning a tap, would consider it most inconvenient to have to draw their water from a well, and carry it into the house. Why should they not be anxious to save the time and trouble connected with the use of coal when they can avoid it all, and light their fires by turning on a tap and applying a match?

Another great advantage of the use of gas is the complete control one has over the temperature of a room. It can be kept constantly at the same heat, or the temperature can be raised or lowered as desired. In a case of illness, this control is of the greatest advantage to the patient; any temperature desired being available during the day or night. Another point is the speed with which the temperature of a room can be raised, and how evenly the temperature is kept during the day by the gas, but how erratic it is by the coal-fire. A further advantage of the use of a gas-fire is that by it the ventilation of a room can be adjusted so as to change the air at a steady and constant rate without causing unnecessary draughts, as so often happens with the coal-fire.

Therefore, to the use of gas I think we must look for immediate improvement. But the various gas undertakings, on their part, have still improvements to make; and I am surprised that at least some of them are not making the progress that one would expect. It is imperative that, in the process of gas making, they must produce a better form of coke than they have hitherto done—something that can be burned in an ordinary open grate as easily as coal can. Such a product, even if sold a little below the price of coal, would fetch a higher price than the ordinary coke; and this increased price would go to reduce the price of gas, so that those who used gas would get it at a lower rate, and those who still preferred the open fire in the old-fashioned grate, as well as those beyond a gas-supply area, would get a smokeless fuel, and their inducement to use it would be its lower price as compared with coal. It is strange those controlling gas-works are so slow to move in this direction. When we get to this stage, I think it is safe to predict that domestic smoke should be no longer tolerated.

Of course, electricity is the ideal heating force; and we are all looking to it to furnish a complete solution of the question in the future. But there is a good deal to be discovered about its application yet. Meantime, cooking by electricity is quite practicable, and, with the appliances now in use, it is economical. It is also absolutely clean. But for the warming of a room, it is still too expensive for most people. While we are waiting for the more universal adoption of electricity, we can meantime rely on gas for all our domestic requirements.

One hindrance to the use of gas and electricity must be immediately removed, and that is the unfair and financially unsound method that many corporations have of penalizing the users of gas and electricity by taking large sums from the annual revenue of these departments, and devoting them to what they call relieving the rates. Many towns take such sums from their gas undertakings as necessitate charging the gas 2d. or 3d. per 1000 cubic feet more than it should be. This method of contributing to the rates does not, in reality, lower the rates, but only alters the incidence of taxation. It means that the householder who has fitted his house with gas appliances, and thus kept the atmosphere pure, is compelled to pay more in rates, whereas his next-door neighbour, who, by continuing to burn raw coal in the old-fashioned way, really pays less in rates while he is helping to poison the atmosphere for himself and the community. Unfortunately, this contribution is levied by many English local authorities; but I am glad to say that the Corporation of Glasgow, during the forty-five years that they have owned the gas-works, have not adopted this policy. The Consolidated Gas Act we got two years ago does not allow us to do it; and I hope that the Government will see that this power is withheld from local authorities wherever possible, as it is a hindrance to progress. The author added that the Right Hon. John Burns indicated that, after this, the Government intended to introduce a clause, whenever possible, to prevent the appropriation of profits in aid of the rates.

* See "JOURNAL," Vol. CIX., p. 39.

Report on Progress.

Following, Mr. John B. C. Kershaw, F.I.C., presented a number of notes on the recent progress in the campaign against black smoke in the United Kingdom. They indicated the large amount of current activity, and that much success is ensuing from it. A sensible amount of educational work is proceeding in London and other large centres, and voluntary agencies engaged in the crusade have been presenting increasing vigour.

To show how rapidly gas is displacing solid fuel for cooking and heating purposes, he quoted figures showing the increase in the total number of gas-cookers in use in the United Kingdom during the period 1902-1912. The totals are: For 1902, 998,878; for 1912, 2,921,299—an increase of 1,922,421 in the ten years. This huge total, it must be noted, does not include gas-fires. The correctness of these figures is supported by the total given in the 1910 report of the Coal Smoke Abatement Society, for the gas heating and cooking appliances installed by the principal London gas companies. This total was given as 1,300,000. Other large towns can, of course, show a similar extension of the movement to utilize gas for heating and cooking purposes, while the electric light and power companies could provide evidence that electric power is displacing the small power generating plants, which at one time were a common feature in large towns and centres of manufacturing industry. Another fact of importance in its bearing upon the Smoke Abatement movement is that, as a result of a correspondence upon Sheffield's smoke problem, carried on in the "Sheffield Daily Telegraph" in January of the present year, the steel manufacturers have appointed a Committee to investigate the possibilities of gas and electrically heated furnaces, as substitutes for the smoke-producing reheating furnaces of the city. The writer is convinced that the gas-engine and oil-engine will gradually supplant the steam-engine as a prime mover, and with this change the burning of bituminous fuel under steam-boilers will give place to its utilization in gas-producing plant. Gas-fired boilers and furnaces will also take the place of those now heated by solid fuel; and in this new development Bone's system of surface or flameless combustion will play a leading *rôle*.

Mr. W. Nicholson, the Chief Smoke Inspector of Sheffield, gave a considerable amount of information regarding the suppression of smoke by technical advance in industrial heating processes, taking Sheffield as an example. Incidentally, he referred to the fact that many of the high-temperature furnaces are now being successfully worked by gas and electricity. Some of the manufacturers anneal steel with gas, and others with coke. He strongly urged Government action by the creation of a "Smoke Department."

The concluding papers at the morning sitting were by Dr. R. C. Benner, Ph.D., on "Smoke Abatement in Pittsburgh;" and by Professor C. W. A. Veditz, Ph.D., LL.B., of Pittsburgh University, on a "Tentative Outline for an Investigation into the Economic Phases of the Problem."

Gas and Electricity Appliances in London.

The Secretary (Mr. Lawrence W. Chubb) here stated that since Bailie Smith's paper was put in type, he (Mr. Chubb) had obtained up-to-date statistics as to the gas and electric appliances supplied by the gas companies and electricity authorities in London. The gas companies had now supplied 1,494,000 gas heating, cooking, and hot-water appliances; and this number had grown from 46,000 twenty years ago. Five years ago, the total was 989,000. The electricity authorities informed him that five years ago the horse-power connected was 208,806. The consumption of electricity for power purposes in 1909 was 207 million units, while in 1911 it was 242 million units. The quantity of coal used last year in the municipal and privately owned electricity supply undertakings in London was 560,000 tons.

Gas and Coke in the Discussion.

The discussion was opened by Dr. Hawksley, who considered the Smoke Abatement Society and similar societies would be well employed in trying to get gas and electrical heating installations in huge block of offices, shops, and kitchens where sentiment did not prevail. Sentiment, he thought, was the most important thing they had to combat in connection with smoke abatement. Among the subsequent speakers was Alderman Haigh, of Halifax, who remarked that one of the chief difficulties they had to contend with, in trying to get the price of gas reduced to such an extent that it would be universally used for heating, was the practice of taking so much of the gas profits in order to relieve the rates. Although the town of Halifax was a comparatively small one of 100,000 inhabitants, this year, out of the gas-works balance, they were contributing no less than £19,000 in relief of the rates. When it was remembered the rates with the relief amounted to 9s. 8d., it was a very difficult thing to persuade the members of the Council to agree to relinquish the assistance. Notwithstanding this difficulty, they were selling gas at 2s. per 1000 cubic feet. They were also proposing to loan-out gas-cookers free, fix them in the houses of the ratepayers free, and to supply them with gas at the price he had mentioned, or a little less. By this innovation, they would increase largely the use of gas for cooking. In the electricity department, they were making a concession in order to encourage power users to turn from boilers and steam to electricity. They had adopted a scale which would bring it down to something like ⅝d. per unit for power users; and they thought this would help in the same direction.

Following, came Mr. Clayton, of Manchester, who thought Bailie

Smith had struck the keynote in saying that the solution of the smoke problem depended upon the utilization of gas and coke. He thought it escaped the public notice that there was available a large production of coke from the manufacture of gas. He regarded the ignoring of coke as a great mistake; and if the price of coke was at a proper figure, it should be up to the price of coal. If this was so, the price of gas could be reduced to such a degree as to enable it to be used for the whole day. He thought that coke should be employed more than was the case at present for central heating. Education in the use of gas and coke was what was wanted, because he failed to see that, even in towns where gas was sold for 1s. to 1s. 4d. per 1000 cubic feet, gas-fires were used any more than where gas was at 2s. He thought a reduction of 3d., 4d., or 6d. per 1000 cubic feet would not materially affect the situation, unless there was an educational committee in the large towns to push gas. He considered if they could get such a committee formed with the corporation as a basis—a committee of gas, electrical, and other engineers—a great deal of good could be accomplished. There was a speaker from Sheffield who held that young people ought to be educated to use gas-fires. A great deal was being done by the Sheffield Gas Company in pushing the use of gas-fires and gas-furnaces. Last year the Company had 78 gas-furnaces in use. Provost Mackean stated that at Paisley they had been supplying gas-cookers free for some years.

In his reply to the discussion, Bailie Smith stated that he believed, in educational work, demonstration was the best thing to attract the public. At the last lecture by their Gas Engineer (Mr. Alex. Wilson) there were about 900 persons present, and two lady cooks gave a demonstration. After this, they had hundreds of applications for cookers. They lent the cookers free of charge. At first he was averse to giving them free. But the result was that, whereas in February last year they fixed 400 cookers, in February this year they fitted 1400. Actually, the cookers were not free, as the price of gas covered them. As to electricity, they came as low as ½d. per unit in exceptional cases for power.

At the afternoon sitting, Captain H. Riall Sankey, R.E., M.Inst.C.E., presided.

The Domestic Fireplace.

In the first paper, by Professor W. R. E. Hodgkinson, the author held that we are little further advanced as regards the ordinary house fire than our ancestors, who started the use of coal in fireplaces constructed for wood fuel. Practically, and in addition to a limited use of electricity and smokeless solid fuels, all that seemed to have been done to combat this double waste of fuel and air in private households was the introduction of the gas-fire with its asbestos radiator. But this did not completely stop the production of sulphuric acid, although the amount was much less from gas than from the original coal. Dust was certainly avoided, but the failing of the asbestos fire was in the nature of the radiating material. It was a poor radiator. Rusty iron was much better, but unsightly when cold; and this offended the feminine æsthetic eye. A red clay containing much oxide of iron was superior to asbestos as a radiator. But the number of gas-fires was small in comparison to the open grate raw-coal fire. These were worse sinners than the tall chimneys of works, both intrinsically and from their greater number.

The employment of coke of different kinds in small fires was much better than coal; but still some sulphur compounds were retained to an extent even in the best coke, and oxidize or burn to sulphuric acid, which was one of the most effective fog producers, even in a comparatively dry atmosphere. But coke might easily be improved as regarded its sulphur content by treatment with lime in a way that could not be done with the original coal. Gas coke if slacked with lime water (or weak milk of lime) becomes impregnated with lime, which retained to a great extent the sulphur, as a sulphate when the coke was burnt in an open grate. With prepared or briquette fuels this addition of lime could easily be made. Unfortunately, nearly all these briquettes were made with some kind of pitch as a binding material for waste coal or coke, and consequently produce both tarry and acid smoke. As the central heating or steam heating of small houses was practically out of the question, the alternative was to use cleaned coke or gas-fires.

Dr. John Owens contributed a paper on "Wasteful Power Production;" and following this was one on "Stoking" by Commander W. F. Caborne.

Solid Smokeless Fuel.

Passing on to a paper on this subject by Mr. W. D. Scott-Moncrieff, he referred to his original proposition in 1880 as to the part-carbonization of coal by gas companies for the purpose of producing a smokeless fuel. Twenty-five years passed when the subject was revived in 1905 at the Smoke Abatement Conference at the Horticultural Hall in a paper by the late Sir Charles Cookson, in which he alluded to a newly invented and more economical pattern of coking-oven at work in Germany, which provided a "charred coal." An article on the subject in the "Journal of Gas Lighting" concluded with a further expression of the opinion that, if such a fuel was required, gas companies were the proper bodies to provide it. In 1906, patents were taken out for improvements on the lines described; and a company with a large capital was floated for the purpose of exploiting the patents commercially. The author did not go into the history of the company; but he quoted Professor Lewes's figures as to the cost of gas made by high and low temperature carbonization. He proceeded:

Summing up the evidence that is available from one of the large gas companies and two companies who have patents for systems of partial gas extraction, the writer has arrived at the following conclusions, viz.: (*a*) That the proposals he made in 1880 of only extracting a part of the gas from the coal and using the residual fuel as an improved substitute are sound both from a scientific and a commercial standpoint. (*b*) That the object of every gas company has hitherto been not to make a partial but the greatest possible extraction of gas from the coal in their retorts, and that this practice will continue until they are convinced that it is worth their while, from the point of view of their dividends, to alter their plants and the general routine of their business. (*c*) That they now regard their proper function to be the selling of gas to their customers, and look upon the production of coke and tar as subsidiary items. (*d*) That so long as this is their policy, they are not likely to exert themselves to produce a fuel which is smokeless and better than coke, nor a better material than their ordinary tar. Since gas of low illuminating power is now in general use, the high candle power of the gas produced from an arrested distillation does not appeal to them at all. (*e*) That nevertheless the gas companies are the proper persons to produce a good smokeless fuel and more valuable tar, because they must always have much better opportunities for selling their gas than private companies who must find new customers for all they do not require themselves. (*f*) That a great amount of prejudice has already been overcome, and that the gas companies are only waiting to be convinced that the adoption of partial extraction will yield a good commercial return for the expense and trouble it must entail.

Coming now to the practical point as to how far the system of arrested distillation may be regarded as the best solution of the smoke problem, the writer has arrived at the conclusion, on the strength of recent experience and experiment, that he was justified in 1881 in regarding it as the best solution of the problem, both commercially and from the point of view of the community, always presuming that certain difficulties could be overcome. The objections have now been reduced to two: (1) Irregularity in the quality of the material produced, arising from uneven conditions in the retorts, due to caking. (2) The effect of low-temperature extraction in producing gas so rich in tar that it is not conveyed away, but remains behind in the retorts and is not only lost as a bye-product, but deteriorates the quality of the fuel. Although these two are the only remaining difficulties that the writer knows of, it must not be supposed that they are unimportant because they are not numerous. The first leads to complaints from customers that the fuel is no better than, if so good as, ordinary coke; and this makes the process a commercial failure. The writer, after a continuous experience of more than two years, having had no fault to find, is told that he has been peculiarly fortunate. The difficulty in removing the tar along with the gas has apparently been overcome by extracting it under a partial vacuum. This is a simple, and should be an effective, remedy. It seems as if only one difficulty remains—that of irregularity in production, due to caking in the retorts; and the writer thinks this cannot long defy the ingenuity of invention.

One advantage of the system from a commercial standpoint must be admitted even by the most prejudiced gas manager, and that is the saving in wear and tear and the constant worry as to when and how to make renewals, due to the high temperatures now in vogue compared with the low temperature required in the case of partial distillation.

Suction-Gas Plants.

The next paper was on the above subject; and the author was Mr. George A. Goodwin, M.Inst.C.E. The contribution was generally descriptive. Among other points, he stated that the largest power of which he knew produced by these self-contained plants using one engine was about 220-horse power; but this, of course, could be easily increased by coupling two or more engines together. The following extracts as to costs will be found useful.

Whether the plants use anthracite, coke, coal, wood chips, &c., as fuel, the chief difference in their construction is in the size of the grate and furnace—charcoal requiring a slight increase as compared with anthracite. Presuming a gas-engine has been working with town gas, and is then put to work on anthracite or charcoal, the power obtainable would be reduced by about 10 per cent.; while if worked on coke, the reduction would be about 15 per cent. This, of course, is due to the lessened calorific values of the gas produced.

The consumption of fuel in producer-gas plants, and which makers would guarantee, can be taken as varying from:

0·75 to 1 lb. per B.H.P. for anthracite.
0·80 to 1·25 lbs. per B.H.P. for coke.
0·85 to 1·5 lbs. per B.H.P. for charcoal.

These quantities are given within limits, because they would vary with the calorific value of the fuel—that is to say, the British thermal units that can be got out of it; and also depending on the size of the plant as well as on the construction of the details of the gas-engine that affect the economy.

The oil consumption for gas-engines—an important item—can be taken as 0·002 pint per brake-horse-power hour, or (say) 11 gallons per 60 hours for a 100-horse power plant. All oil used for bearings, which should be fitted with oiling rings, is recoverable and re-used after filtering.

As regards the question of depreciation, maintenance, or upkeep charges in connection with producer plants and engines, I estimate—

	Producer, per Cent.	Engine, per Cent.	Combined Plant, per Cent.
Depreciation	8	6·0	6·5
Maintenance	4	3·5	3·6

From inquiries I have made from time to time, I have not heard that any plant supplied during recent years has yet been worn out or discarded; so it is impossible to say yet how long such plants will last. But there is no reason that I can see why they should not last as long as steam ones, and with much less expense to keep them in an efficient condition. One firm told me they had a 190 brake-horse-power set working night and day for two years.

These plants require very much less attendance than steam ones; permanent stokers being unnecessary, except in large plants. A skilled man, however, should have charge, but to only occasionally look after the plant, particularly at week ends, and to see that the cylinders, piston heads, sparking-plugs, and valves are kept clean, while an unskilled man can easily take working charge, to stoke the producer, which is very easy, only requiring a bucketful or two of fuel at regular intervals, depending, of course, on the nature of the fuel and the work the engine has to do. Clinkering has to be done only two or three times a day. The work is light, the plant after starting being automatic, and even with a 150 to 200 horse power plant the attendant would be free several hours a day. I am satisfied that suction-gas plants as now made are reliable.

Up to the present, satisfactory small and moderate size producers for working gas-engines that will burn bituminous coal have not been put on the market. But I know of one firm who have solved the problem;

and only a couple of weeks ago started a 50-horse power plant, which is working satisfactorily. Some little time must, however, elapse before it is ready for putting this before the public. When large quantities of gas are required for working large power engines, such as 2000-horse power and upwards, or for heating and furnace work, then bituminous coal can be used with advantage, as the value of the bye-products would practically pay for the cost of working.

The water consumption in these plants is about 1½ to 1¾ gallons per brake-horse-power-hour—viz., 15 to 17½ lbs., which covers both the furnace and the scrubbers. These figures can be compared with the quantity of water required for steam plants, to which, of course, has to be added, in the case of condensing engines, the very large quantity required for condensing purposes, which for jet condensing is about 32 times the quantity of steam used, and for surface condensing about 30 times. But in properly-designed plants a great portion of this can be used over again.

The thermal efficiency of suction-gas plants is much higher than in the case of steam, as 24 to 25 per cent. of the energy in the fuel is available at the circumference of the driving pulley, while in steam it is only 9 to 10 per cent. Thus a firm in the North told me that they had a 100-H.P. plant which had been running for the last three years or so, giving every satisfaction. The furnace lining had not been renewed; but a few fire-bricks had been replaced. The plant worked 56 hours per week; and they consumed 3 tons of coke and ½ ton of anthracite, which included stand-by losses, while previously they used 16 tons of coal. Another firm have two 350 brake-horse-power sets worked in tandem. They worked 56½ hours per week and use 4 tons 19 cwt. of good gas coke, which comes out to the very low figure of 0·85 lb. per brake-horse-power.

The cost of working gas-engines with suction-gas producers is very low—in fact, it is one of the most economical systems. The plant can be started very quickly, even when cold, (say) in thirty to forty minutes for a large plant, and only requiring a few minutes after the plant is shut down, (say) from six p.m. to six a.m.

German Experiences.

Dr. Kobbert, Manager of the Königsberg Gas-Works, was down for the next paper; and an abstract was presented. The subject was Smoke Abatement in Germany. This stated: The following principles have been recognized as governing all attempts to minimize smoke in Germany: Chemical and calorific valuation of the fuel ought to precede its selection for any purpose. The type of furnace and method of firing adopted ought to be chosen in relation to the cheapest and most easily transported coal available in the locality of the works where it is to be used. Having selected a grate and fuel suited to one another, the question of the best method of supplying and regulating the primary and secondary air must be considered.

The difficulty of avoiding smoke with household fires and with bakers' ovens is next dealt with. It has been recognized, however, in Germany, that there comes a point when the attempt to obtain the smokeless combustion of bituminous fuel becomes unprofitable, and that the only real solution of the bituminous smoke problem is to forbid the use of bituminous fuel. This opinion favours the substitution of anthracite, coke, and oil for bituminous fuel; and, if the latter must be employed, the combustion of the volatile constituents of the coal separate from the solid. The slow combustion stove burning coke, or the "Kacheloven" burning coal, are both smokeless methods of heating houses. Hot-water heating is also being widely employed in Germany for dwelling-rooms and flats. The use of oil for heating purposes is extending. As regards the manufacture of producer gas and water gas from coke, or of illuminating gas from bituminous coal, these are all extending rapidly; and it is interesting to note that coke-oven gas is now being delivered by pipes, in many of the smaller German towns and villages, for heating and lighting purposes. The author concludes that gaseous fuel is, without doubt, the most practicable and cheapest agent for obtaining heat without smoke at the present time.

The final paper at the sitting was by Mr. J. Stothart Pearson, on "Hand-Fired Burners."

"Coalexld" and Other Solid Smokeless Fuel.

In the course of the discussion, Mr. W. Wingate, speaking of "Coalexld," said they had abundance of practical proof, and he thought they might say that it had been established beyond a shadow of doubt, that the process diminished the sulphur in the coke. He should like to mention one or two facts. In a large building near the Royal Exchange, which was supplied with "Coalexld," the buyer doubted whether it was worth the extra price paid compared with the price of ordinary coke—5s. to 6s. per ton more. The buyer asked his engineer whether it was really worth so much more. The engineer's reply was: "When I am using ordinary coke, every time I open the furnace-door, I am almost suffocated with sulphur. When I am using 'Coalexld,' I experience practically no sulphurous smell; and it is invaluable so far as my health is concerned." At the Midland Grand Hotels at St. Pancras, Liverpool, and other places, they had complaints about the sulphur fumes when using coke in their sitting-rooms and bedrooms, the chimneys of some of which smoked badly. They had no such complaints when using "Coalexld." The Midland Grand Hotel, London, had a contract for ordinary coke from the Provinces at 14s. per ton (as they obtained it carriage free). Against this they paid 24s. per ton for "Coalexld"—exactly 10s. more per ton—which proved its additional value. Hotel chefs stated that no sulphurous fumes troubled them now at the grills, or in the kitchen. If the "Coalexld" process neutralized the volatile sulphur in coke, it was a great boon to the public health. It followed, almost as certain as day followed the night, that it diminished the volatile sulphur in the gas, which caused so much mischief; and it would be a great boon also to the gas industry. Mr. H. Kendrick, of the Stretford Gas-Works, had proved, by tests extending over several months, that the system reduced the sulphur in gas. An exhaustive test recently made by a London gas engineer of very high standing also showed that the system not only reduced the sulphur in the gas sufficient to be of value to the gas industry, but it also, without doubt, increased the yield of ammonia. Mr. Kendrick and others likewise found that it increased the yield of gas by 400 to 500 cubic feet per ton. Other engineers could prove this for themselves. He also referred to an experience where, in greenhouse use, only half the quantity of "Coalexld" was required as compared with coke.

Mr. O. G. Parker also joined in the discussion, and stated that, with low-temperature carbonization, there was no trouble as to the regularity of the product. He had had a considerable amount of observation and experience during the last two or three years; and he could affirm that, by the method of low temperature and high vacuum, the whole subject of smoke could be ended. The retorts did not wear out like high-temperature retorts. The work was quickly performed—about one-third of the time that the ordinary distillation of coal occupied for the production of gas; and there was nothing whatever lost. It was far better to take out of the coal all the illuminating products which formed smoke.

The Final Day's Proceedings.

The chair at the morning sitting on the third day of the conference—which was devoted to the legal and legislative aspect of the question—was to have been taken by Mr. Julian S. Corbett, the Chairman of the Conference Committee; but in his absence through indisposition, his place was taken by Mr. W. Whitaker. There were only two communications to be submitted; the remaining two being reserved for a subsequent evening session.

Suggested Aims of Legislation.

The first of the papers was contributed by Mr. Joseph Hurst, Barrister-at-Law, who dealt with a question put forward by himself—"Is further legislation regarding the smoke evil necessary; and, if so, what should be its aims?" Referring to the provisions on the subject contained in the Public Health Act, 1875, he pointed out that the issue of grit from chimneys was not dealt with; but as this had become a serious nuisance (as the result of artificial draught in furnaces), and was capable of remedy, it would be generally agreed that an addition should, on a convenient opportunity, be made to existing public health legislation dealing with the emission of grit from furnace chimneys. Such an addition had been secured by the Bradford Corporation in a Local Act obtained by them in 1910. A far-reaching alteration of existing legislation had, however, he said, been suggested in important quarters, and had received considerable support. This was the deletion of the word "black" from section 91 of the Public Health Act, 1875, and from section 24 of the Public Health (London) Act, 1891. These enactments would then read: "Any chimney (not being the chimney of a private dwelling-house) sending forth smoke in such quantity as to be a nuisance shall be deemed to be a nuisance," &c. For reasons which he set forth, the author submitted that the deletion of the word "black" would make practically impossible the abatement by the present summary procedure of "smoke in such quantity as to be a nuisance." But in view of the fact that there was much smoke that was not at all black (on the contrary, that was almost white, or quite yellow) which was at least as much within the mischief to be dealt with by public health legislation as smoke described as black, he suggested that, in any amendment of Statute Law on this subject, it would be desirable to add to the present word "black" the words "or dense." Finally, he expressed the opinion that the Bill now proposed by the Smoke Abatement League would increase the difficulties in the way of procuring smoke abatement, and that the efforts of those interested in the matter should be directed to a simplification and enforcement of the existing law, rather than to untried methods.

Principal J. W. Graham, the President of the Smoke Abatement League of Great Britain, then read a paper explaining the proposed Bill of the League to deal with the matter of smoke abatement. In the Bill as drafted, sub-section 2 of section 1 read: "Any chimney (not being the chimney of a private dwelling-house) sending forth or emitting smoke in such quantities as to be a nuisance, inconvenience, or annoyance, shall be deemed to be a nuisance liable to be dealt with summarily;" but Principal Graham said that, speaking personally, he would have been prepared to meet Mr. Hurst's objection by altering the provision to some such words as "sending forth or emitting black smoke or other smoke in such quantities," &c. Section 3 of the Bill says that—"Except in the areas of such local sanitary authorities as shall satisfy the Local Government Board that they are carrying out their duties with regard to smoke abatement, the Local Government Board shall constitute, by Provisional Order, Local Smoke Abatement Authorities," &c. In his paper, Principal Graham pointed out that what they desired was to create some active and well-equipped power, which would keep the plea for immunity within the narrowest limits consistent with justice. It was admitted that, by one means or another, boilers could be made smokeless, and that in the majority of cases, and in the long run, capital investment in this direction would be remunerative. It was also admitted that, by gas-firing, or by sending the gases in succession through other furnaces, the Potteries might be redeemed from their present horrible condition; and it was still further admitted that puddling had, in many instances, been done successfully by gas, and that low-grade steels could be re-heated in this or other ways. Proposals were in the air, and claimed practical achievement, for doing the same for high-class steels—a claim, however, which was still denied by some. Reckless stoking was common in all these trades. Care had been taken in the Bill to extend smoke to include mineral grit, such as was common from some of the cheaper coals in Yorkshire. Scales of fines were suggested; and the character of smoke inspection was to be revolutionized. On domestic smoke no legislation was to be attempted.

The discussion on the two papers proved to be a long and interesting one; and it centred largely round the advisability of including or excluding the word "black." Mr. Whitaker remarked that, strictly speaking, black meant the absence of all colour; but a wider view had to be taken in interpreting such words, and black smoke must be held to mean dark smoke. In the regions of the cement works down the Thames, one would find a very irritating smoke, which was not black, though it should be amenable to the law just as much as other smoke which might be more highly coloured and yet not half so bad. They must assume that the people who had to carry out these legal enactments would proceed with a certain amount of common-sense. Bailie

Smith said one thing they in Glasgow felt was wanted was a new authority with jurisdiction all over the country—a body that would make the local authorities enforce the Acts that might be in existence. Councillor Hanney (Glasgow) drew attention to the importance of educating people on the subject; and he added that their Sanitary Inspector, Mr. Peter Fyfe, had done excellent work in this way. One delegate inquired whether there was any chance of the Bill going through within the next five years. He felt that, if facilities were not promised by the Government, they were simply wasting a great deal of time and money in connection with the measure. Principal Graham remarked that, if the Bill passed in five years, they would feel that part of their life-work had been successful; but the immediate use of the Bill was to form a kind of foundation round which discussion might centre.

At the evening session, Mr. Whitaker again presided—a message having been received to the effect that Lord Justice Fletcher Moulton, who was to have taken the chair, was not well enough to be present.

A Plea for a Royal Commission.

A communication contributed by Mr. Julian S. Corbett, Barrister-at-Law, gave some useful information with regard to smoke legislation abroad; and the final paper of the conference was by Dr. H. A. Des Vœux, the Hon. Treasurer of the Coal Smoke Abatement Society, who put forward a plea for a Royal Commission. He said that, for the purposes of his contribution, he could omit the greater number of the large army of smoke makers—the private householders—because the domestic smoke problem was tending towards a settlement by voluntary means, as was shown by the remarkable growth in recent years of the use for cooking and heating of gas, electricity, and various forms of solid smokeless fuels. The proposal he had to make, therefore, necessarily dealt with the relatively small number of persons carrying on some trade or manufacture who were responsible for the emission of smoke. It was possible to abate smoke without inflicting any hardship on industry; but from a variety of causes, little or no progress was (with some notable exceptions) being made in this direction. If it was impossible to prove that the smoke was black, there was no redress under the present Statute Law, however seriously the smoke from a factory might defile a whole neighbourhood. A great deal of dissatisfaction prevailed; and a number of local authorities had already secured special powers. Under these circumstances, the Society had come to the conclusion that the Government should be urged to appoint a Royal Commission to carefully inquire into the whole subject, with a view to the passing into law of a General Act. No such inquiry had taken place in this country for 67 years; and there could be no doubt that its researches would prove invaluable from the point of view of the manufacturer, as well as of those who aimed at the abolition of the smoke nuisance. The author concluded by giving a list of matters into which the Commission might be directed to inquire.

The Resolutions.

The first resolution as passed by the conference (it was proposed by Dr. Des Vœux, and seconded by Principal Graham) was in the following terms: "That this meeting of delegates of the International Smoke Abatement Conference recommend that the offer of Mr. Gordon Harvey, M.P., to introduce into Parliament the Smoke Abatement Bill prepared by the Smoke Abatement League, be accepted; and that should such Bill not be passed into law during the current session, or should there be no prospect of the Bill passing in 1913, steps should be taken to organize a deputation to the Government to urge the appointment of a Royal Commission to report upon the whole subject of smoke abatement."

Next it was agreed (on the proposition of Dr. J. S. Owens, seconded by Mr. J. B. Kershaw) that, in the view of the conference, it was desirable that immediate steps should be taken to decide upon, and secure the general adoption of, a standard method for the measurement of atmospheric pollution by smoke and other products of combustion and dust, in order that the data now being collected might possess comparative value. A Committee was appointed to draw up details of a standard soot and dust measuring apparatus and method of use.

Following this, the conference placed on record their approval of the proposal of Professor C. W. A. Veditz and Dr. R. C. Benner, of Pittsburg University, that steps should be taken to study the economic phases of smoke pollution; and they referred the proposal to the Coal Smoke Abatement Society and the League, with the recommendation that an effort should be made to organize in this country action on lines similar to those of the American investigation, in order that the inquiry might possess comparative value.

The fourth resolution expressed the conviction that much of the smoke nuisance in connection with industrial works is due to inefficient hand-firing; and it stated that, "as the experiences of the Hamburg Smoke Abatement Society on the Continent, and of the Coal Smoke Abatement Society at the Borough Polytechnic Institute in London, as well as of such cities as Glasgow and Liverpool, show that stokers are anxious to avail themselves of special instruction calculated to increase their knowledge of their calling, the conference desire to impress upon local authorities and the directors of technical institutes the importance of establishing classes for the training of stokers, and of granting certificates of competency."

Lastly, the work done by the readers of the numerous papers was suitably acknowledged; and well-deserved votes of thanks were accorded to the Chairman, Secretary, Treasurer, and other officials, for all they had done towards making the conference a success.

Prescot Gas Company.—The annual meeting of this Company was held last Thursday. The Chairman (Mr. Henry Cross) reported that they had had a very successful year; the gross profits being £278 more than the previous year. The consumption of gas showed an increase of a little over 4 per cent. The number of consumers had been increased by 146. The usual dividends were declared, and a vote of thanks was passed to the Manager and Secretary (Mr. John E. Hall) and the staff for their efficient services.

ABERDEEN GAS-WORKS.

Annual Inspection by the Council.

On Monday last week, the members of the Aberdeen Town Council made their annual visit of inspection to the Corporation gas-works. The company included Lord Provost Maitland, Mr. Samuel Milne, the Gas Engineer, and Mr. L. Anderson, the Lighting Inspector.

The party first proceeded to the Gallow hills, and inspected the gas-holder and governor, which controls the northern part of the area of supply, including Woodside, Bucksburn, Stoneywood, and Dyer. Then they went to the gas-works. The first part of the works under inspection was the method employed for taking delivery of oil for the manufacture of carburetted water gas. A good deal of interest was displayed in the various parts of the apparatus employed in the system—particularly the Kerr steam-turbines, the air-blasting appliances, the generators, and the carburettors. One point which calls for special mention is the absolute control of the whole plant which is exercised by the assembly of the valves in such a manner as to admit of their operation by the minimum of exertion. The experimental works, where the coal testing is carried out, was next visited; and the whole routine of coal-gas manufacture was observable by the miniature plant which was in operation. Next came the laboratories, and the workshops. In the retort-house a profitable halt was made; and subsequently the different adjuncts to the works came under review—gratification being expressed at the admirable way the various details are looked after.

At the luncheon, which was served in the Engineer's office,

The Lord Provost asked the company to drink to the prosperity of the gas-works. He remarked that he did not know if they had understood all that they had seen, or that they could improve on the quality of the gas manufactured by Mr. Milne. They had, however, learned something that probably most of them did not know before—that a proportion of the gas was manufactured from water. Altogether what they had seen had impressed them very deeply that the management of the gas-works was an important subject, and required a man at the head of it with a great deal of technical knowledge and skill. By their Convener and Committee, and particularly by Mr. Milne as the responsible head of the department, the undertaking was admirably and efficiently managed. They were glad to know that they had still a reserve to keep the city going in light and for power purposes for at least a few weeks; but he trusted the coal strike would be ended, and fresh supplies available long before their reserve was exhausted.

Mr. Sangster, the Convener of the Gas Committee, in reply, said the gas undertaking was one of the largest departments under the Corporation. Its capital value at the present time amounted to £446,000; and while they had seen a great portion of the amount, there was a value of £163,000 represented by the mains and service pipes, consumers' meters, and gas appliances which they had not seen. Keeping this large sum in view, it would surprise some of them to learn that the total liabilities on the undertaking at July 31 last were only £133,000. At the same date, the total annual revenue amounted to £125,467. In the year 1902, the gas manufactured was 626 million cubic feet; in 1907, 725 millions; while this year it was estimated that it would amount to 840 millions. In 1902, the revenue from gas sold was £93,700; in 1907, it was £89,500; and for this year it was estimated to yield a sum of £90,000. They had therefore to manufacture 214 million cubic feet for £3000 less money than in 1902. The reduced revenue for gas sold was, of course, in consequence of the reductions which had been made from time to time in the price of gas. In 1902, the price to the general body of consumers was 3s. 2d. per 1000 cubic feet; in 1907, 2s. 7d.; and for the current year, 2s. 3d. For power purposes, the gas was sold in 1902 at the rate of 3s. 2d. per 1000 cubic feet; in 1907, at 2s. 4d.; while this year it was 1s. 11d. All these rates were subject to discounts. The slot-meter rate had also dropped 1s. 3½d. per 1000 cubic feet during the same period. Were the rates of ten years ago in vogue for the current year, there would be an increase in the revenue of £38,800 for the year. The revenue from residuals—coke, tar, and other products—had assisted very materially the reduction in the price of gas. In 1902, they realized a sum of £16,856; in 1907, £20,597; and this year it was reckoned they would yield about £25,700. Since last year, the Town Council had adopted a policy which, judging by the results, was meeting a felt want in the community, and would do much towards solving the smoke abatement question. He referred to the fixing and supplying of free cooking appliances, and the hiring of gas-fires and other heating devices. The exhibition promoted by the Gas Department in October last, which was very largely patronized by the public during the whole period of the fourteen days on which it was opened, had done much to popularize the use of gas for all purposes, and had left an impression which could not fail to be of mutual benefit to the community and the department. Probably the best indication one could have of the increasing demand for gas heating and cooking appliances would be obtained from a consideration of the following figures: In the year 1902, there were on hire a total of 1853 gas appliances; in 1907, this was increased to 3572; and to-day there was a total of 10,206 on loan. The last-mentioned figure comprised 3190 fires on hire, and 7016 heating appliances on loan. During the same period, the number of gas consumers had increased from 34,852 to 43,001—an increase of over 23 per cent. Having lent the gas-cooking appliances, they now proposed to give instruction in the proper use of them; so that the consumers might be enabled to make the most out of them. To accomplish this, arrangements were being made for a series of gas cookery demonstrations to be held in various centres throughout the city. These would commence about the third week in April. The history of the Gas Department was one long record of success—showing increase upon increase from year to year. One could not refrain from making some reference to the deplorable unrest in the industrial world at the present time, and particularly to the coal miners' strike. They were fortunate in having a good stock of coal on hand at the beginning of the strike; but when one considered that during the past four weeks a quantity of not less than 10 tons of coal, or its equivalent in oil, were required every hour to produce gas—or 240 tons a day—

one could readily realize that no ordinary stock was required to tide over such a crisis as the one they were at present passing through. They in Aberdeen were in the fortunate position of not being entirely dependent upon coal for the production of illuminating gas, having three years ago put down an installation of carburetted water-gas plant. The adoption of this plant had during the last three weeks saved upwards of 1000 tons of coal, and would, during the currency of the coal strike, represent a saving of about 40 tons of coal per day. The department had still on hand coal, or its equivalent in oil, sufficient to tide over some weeks yet. But should the strike be protracted, further economies would be necessary. Much could be done in this direction. It had been a great pleasure for him to be associated with the department. From the officials and staff he had had the utmost courtesy and assistance, and the Committee had been all that could be desired. It was a well-recognized fact that the Aberdeen Gas-Works were among the best-managed concerns in the kingdom; and this was due in no small measure to the capable and energetic Engineer who was at the head, and to the splendid staff of assistants who ably supported him. He concluded by proposing the health of Mr. Milne and his staff.

Mr. Milne, in reply, said the Town Council in the past had shown every confidence in the staff; and the least the staff could do was to give their very best services. They were fortunate in having such a Convener as Councillor Sangster, who was a gentleman of extensive practical experience. Reference had been made to the deplorable coal strike, which would have one result, he declared, in an increase in the price of coal, which would have to be borne by the general body of consumers. As this was the first opportunity he had had of addressing the Town Council since September last, at which time they officially invited the North British Association of Gas Managers—a body over which he had the honour at the present time to preside—to hold their annual meeting in Aberdeen in September next, he wished to say how heartily they accepted the invitation.

TORQUAY GAS COMPANY.

At the Annual Meeting of this Company, held last Tuesday, under the presidency of Mr. R. P. Kitson, the Chairman, the Directors reported that on last year's working there was a balance of £12,548 to the credit of profit and loss account; and they recommended the payment of the usual dividend of 10 per cent. on the ordinary shares and 7 per cent. on the additional capital. The revenue account showed that the manufacture of gas cost £20,082; distribution, £4374; and management, £1447; while the sale of gas realized £25,453 and residuals produced £7155. During the year 14,438 tons of coal were carbonized, and 204,272,400 cubic feet of gas made, of which 193,249,400 cubic feet were sold and used. In moving the adoption of the report, the Chairman said that, notwithstanding the cries raised as to gas being a thing of the past, and though competition in heating and lighting was severe, the Company, in common with other gas companies, were able to report an increase in the sale of gas to the extent of 6¼ million cubic feet, and also that, for the first time in the history of the Company, their make exceeded 200 millions. However, the sale of gas realized £792 less than in the previous year, due to the reduction in the price; and it therefore seemed that, provided competition was on sound commercial lines, there was no reason to suppose that gas could not hold its own. Owing partly to the better class of coal they had been carbonizing and the good working of the staff, the Manager (Mr. R. Beynon) had been able to obtain the increased yield of 900 cubic feet of gas per ton of coal; and consequently less coal had been used. This meant less in the way of coke and other bye-products; but the sale of residuals produced £400 more than in 1911. The policy of keeping in touch with the consumer had a good effect; and though much had been done in the way of proving what a faithful friend and servant gas could be, the Directors realized that there was still more to be done in this direction. With regard to the miners' strike, the Company were very fortunate in securing a good stock of coal in anticipation of labour troubles. The report was adopted.

DEVON GAS ASSOCIATION.

The Sixth Annual Meeting of this Association was held in Exeter last week, under the presidency of Mr. F. Templer Depree.

In moving the adoption of the report, the Chairman congratulated the shareholders on the satisfactory balance-sheet presented and the prospects of the Company, and asked them to confirm the report and sanction a dividend of 5 per cent. per annum. Though the balance available for distribution was slightly less than in the previous year, it was not due to any falling-off in the business, but to the endeavour on the part of the Association to provide better working conditions for the employees, and to more attention being paid to the consumers. This policy had met with considerable success. During the year the Association had taken over the control of the Sturminster Newton Gas-Works, and considerable developments had taken place in them; while an average increase of 10 per cent. in the output of gas had occurred in the Association's remaining five works. He expressed considerable misgivings as to the prospects for the ensuing year. The Association had, he said, done all they possibly could to prevent an interruption in the supply of gas; having in store at Christmas three times their normal stock of coal. This foresight had enabled them to maintain the full supply up to the present, and to ensure it for a further four or five weeks. Mr. R. J. Rew, in seconding the motion, said the works had been kept in a very high state of efficiency, and would compare favourably with any similar works in the district. A gratifying increase had been obtained in the sale of residuals; and this had enabled the Association to give more attention to the consumers than they could afford to do hitherto. A record quantity of gas had been made per ton of coal carbonized. Though the present prospects appeared decidedly gloomy, there was every hope that the usual dividend would be maintained during the ensuing year. The report was adopted.

COAL STRIKE AND GAS SUPPLY.

Though the progress of events during the past week in connection with the strike of coal miners has been such as to encourage the hope that it will shortly be brought to an end, it has been found necessary to take steps to further economize gas, by making appeals to consumers to restrict their lighting as much as possible, and by stopping the supply between certain hours.

Critical Position of the Gas Supply of Birmingham.

The critical condition in which the community of Birmingham have been placed by the strike has been a source of great anxiety to the Gas Department; and they can plainly see that their resources will soon come to an end unless economy is practised. A special meeting of the Gas Committee was held last Thursday, under the presidency of Alderman Sir Hallewell Rogers, when the position in which the department is placed was thoroughly discussed. The object was to effect an economy in the consumption which would interfere as little as possible with the convenience of the public. Eventually the Committee decided that on Monday, Tuesday, and Wednesday this week the supply of gas should be discontinued between the hours of 12 noon and 8 p.m., at which hour the gas will be turned on again, and remain available until noon the following day. At the end of the week, however, after a consultation with the Lord Mayor and some members of the Gas Committee, Sir Hallewell Rogers announced that the gas supply would be available until 1 p.m. yesterday, and would be turned on again at 7 p.m., instead of at 8 p.m. as originally decided. The Chairman of the Gas Committee told a representative of a local paper that the Gas Department had in stock last Thursday about 14,000 tons of coal, which at this time of the year should be fully equal to two weeks' make of gas. Were the miners returning immediately to work, there would be no need for the restriction decided upon; but in view of the uncertainty as to when the next supplies of coal might arrive, the Gas Committee felt that they could not, in the interest of the city, run the risk of leaving it in darkness. The Committee met yesterday morning to review the situation; and they will meet frequently while the crisis lasts. Every possible arrangement is being made to secure supplies of coal as soon as possible.

Further Measures to Economize Gas.

On the present basis of demand, there was only two weeks' supply of gas at the Brighouse Gas-Works towards the close of last week; and the Corporation, in consequence, decided that the supply should be cut off from 6 a.m. to 6 p.m. on Saturdays, Sundays, and Mondays until further notice.

The Directors of the Farnham Gas Company announced that in consequence of the limited stock of coal they had reluctantly decided to supply gas between the hours of 6 p.m. and 5 a.m. only; and the Company have been threatened by the District Council with legal proceedings if the normal supply of gas was not restored by yesterday.

At a recent meeting of the Gas Committee of the Leeds Corporation, it was reported that as the result of the reduction in the supply during the previous week-end there had been a saving of 5 million cubic feet of gas; representing a decrease of 500 tons in the amount of coal used. The Committee decided to abide by their resolution to cut off gas from 1 p.m. to 6 p.m. each day, except Saturday. This will continue to be the rule until further notice, though power was given to the Chairman to take steps to call the members of the Committee together whenever he thought advisable.

The Gas Committee of the Lincoln Corporation have given notice that the supply of gas will be confined to the following hours each day: 7.30 a.m. to 9 a.m., 11 a.m. to 1 p.m., and 5 p.m. to 11 p.m. The Committee also appeal to all consumers to turn out their lights as soon as practicable after seven o'clock at night.

Mr. T. Banbury Ball, the Gas Engineer to the Rochdale Corporation, has issued the following notice: "In consequence of the prolongation of the coal strike, it is imperative that consumers of gas, for whatever purpose it is required, should exercise the most rigid economy in its use. The resources of the Gas Department are being rapidly exhausted, and a full supply can only be continued for a few more days."

The Salcombe Gas Company have given notice to the consumers that from last Thursday the gas will be turned off the town from 7 a.m. to 6 p.m. They also notified the Urban District Council as to the desirability of extinguishing the public lights at an earlier hour. It was decided to fall in with the suggestion; an abatement *pro ratâ* to be made, and the foreshore lights to be kept burning.

At Wednesday's meeting of the Todmorden Town Council, Alderman Lord made an appeal to the consumers for the exercise of the utmost economy in regard to the use of gas; and he suggested that the publicans and shopkeepers of the town should close at half-past seven in the evening from Monday to Friday, and at nine o'clock on Saturday, until the crisis is over. Other members of the Council suggested that the street lighting should be abandoned altogether, and that places of worship should hold afternoon instead of evening services. It was decided to curtail the public lighting as much as possible, and to ask shopkeepers to restrict as far as maybe the lighting of their business places at night.

Further curtailment of the public lighting has taken place in various parts of the country; among other towns being Accrington, Bangor, Bradford, Broughty Ferry, Dawlish, Denton, Goole, Haslingden, Middleton, Padiham, Stroud, Todmorden, and Tyldesley.

The Great Demand for Coke.

There were the usual animated scenes last Tuesday at all the coke depôts of the Birmingham Corporation; the demand being as great as ever. Some thousands of quarter-hundredweights were served. But the supply did not equal the demand; and three days after the last pay-day the twopences were not everywhere forthcoming. The Gas Department will continue to supply coke to the bakers of the city, and sell it in half-hundredweights to the poor people.

The Gas Committee of the Bolton Corporation have stopped the sale

of coke altogether, except to those poor people who are furnished with tickets from one or other of the local charity organizations.

At a meeting of the Gas Committee of the Bradford Corporation last Friday, a resolution was passed to the effect that until further notice coke would only be supplied to bakers and others engaged in the preparation of food for sale, to hospitals, and to occupiers of cottages. In the case of cottagers, the quantity is to be limited to 1 cwt. at a time; and a cottage is defined as a house rated at less than £10 a year. The idea is to supply poor people. No coke will be sold for consumption at factories, warehouses, shops, offices, schools, clubs, churches, chapels, or even to Corporation departments. It was stated by the gas officials on Friday that the daily production of coke for sale was less than 100 tons.

There were crowds of working people at the premises of the British Gaslight Company, Sculcoates, last Thursday morning, clamouring for the coke which is being sold cheaply to those among whom distress is most apparent. The demand exceeded the supply; and great numbers had to be turned away disappointed. It came to the knowledge of the Manager (Mr. John Young) that hawkers were selling coke at more than double the price that they were paying for it; and as poor people were suffering, he decided to stop the sale to hawkers, and to supply direct to the poorest people at the cheap rate, in order that they might have the benefit. Owing to the great demand, he has had to limit the supply each day.

At Clitheroe, the Gas Department are supplying householders with half-hundredweights of coke at 3½d., and local contractors have had their limit cut down to 5 cwt.

The Gas Committee of the Colne Corporation have discontinued the sale of coke to millowners, but are supplying householders with half-hundredweights, for which there is a growing demand.

The following remarks appeared in the "Derbyshire Advertiser" last Saturday: "With coal at famine prices, and very little of it to be had, local householders will welcome an announcement made by the Derby Gas Company. Although the demand for fuel has led to their receiving some tempting offers from outside firms, the Directors have resolved to reserve the whole of their coke for disposal in the town among their ordinary customers. They have also decided not to raise the price to small consumers, who are for the most part the poorer people, and who fetch it daily from the works in quantities varying from a half-hundredweight to a hundredweight at a time. . . . The action of the Company in thus studying the needs of the community around them cannot fail to commend itself to the public generally."

The Gas Department of the Glasgow Corporation have been selling coke in small quantities of 14 lbs. to 28 lbs. at 1d. per 14 lbs. In the week ended the 23rd ult., the quantities so disposed of at the various stations were: Dalmarnock, 210 tons; Provan, 149 tons; Dawsholm, 23 tons; Tradeston, 250 tons—total, 632 tons. In the first three days of the past week, the quantities were 177, 129, 16, and 148 tons—total, 470 tons.

So great is the competition for the coke available at the gas-works of the Heywood Corporation, that people begin to assemble at the gates before four o'clock in the morning, and wait patiently until six o'clock, the usual hour for opening the gates. Householders are supplied with half-hundredweights, and the sales to local contractors are cut down so as to make the stock go as far as possible.

There was again a great rush for coke at the various gas-works of the Leeds Corporation early last week. At the New Wortley works, the first contractor's cart arrived at ten minutes past ten on Sunday night, and was soon joined by many more, which were waiting in the streets all night and up to seven o'clock on Monday morning, when the opening of the gates enabled them to obtain loads of coke to supply manufacturers and other customers. Large numbers of poor people were at the gas-works from early morning waiting to be supplied with pennyworths of coke, in order to keep some sort of fire in the grate. At the Meadow Lane works there was a similar rush for coke, and 2500 pennyworths were disposed of on Monday morning.

The Manchester Corporation Gas Committee decided at last Friday's meeting to sell coke in penny bags. Mr. William Kay, the Chairman of the Committee, stated subsequently that this action had been taken because of the extraordinary demand there was for coke, and so that the very poor might have a supply, if only a limited one. That morning, he said, before eight o'clock, 5300 tickets had been issued at the Gaythorn works; while at the Rochdale Road station matters were even worse—the applications numbering upwards of 6000. In reply to a question, Mr. Kay said the total quantity of coke sold between the 7th and 28th ult. in half and quarter measures was 3417 tons, representing a loss to the Gas Department of £150 per day, as the Committee could have easily sold the coke at 30s. a ton. "There is no doubt," says our Manchester Correspondent, "that the policy adopted by the Gas Committee has been a very great boon to people residing in the poorer districts. As evidence of the crush there is to get the coke, it may be mentioned that one day last week 16,318 persons were each supplied with a quarter-hundredweight; the quantity having been reduced from a hundredweight to a half and then to a quarter." With regard to the coal in stock at the gas-works, our correspondent says there is sufficient to maintain a full supply of gas for about six weeks yet. He adds: "One effect of the coal strike has been to increase the consumption of gas in cookers. Last Thursday, for instance, the Gas Committee received 369 applications for these appliances, and on the preceding day the number was 312. A good many gas-fires are also being installed in offices and private houses; while householders, having been reminded that the Gas Committee are prepared to supply gas-rings free of charge, with the necessary tubing, have been applying for these handy articles in increasing numbers. It is calculated that by these means the daily consumption of gas has been increased by about a million cubic feet."

Though Mr. T. Canning, the Engineer and Manager of the Newport (Mon.) Gas Company has assured the inhabitants of the borough that the supply of gas can be maintained for several weeks, even in the event of a continuance of the coal strike, the Company have had to restrict the quantity of coke usually sold to the public, as they are themselves using more for fuel.

It was reported at last Wednesday's meeting of the Oldham Corporation Gas Committee, by Mr. A. Andrew, the General Manager, that, with a view to assist poor people, coke in 28-lb. bags was being sold, and the supplies to local contractors reduced by one-half. As the stock was practically exhausted, and the demand in excess of the make, he desired to have some idea as to the views of the Committee regarding further restrictions in the disposal of the coke. It transpired in the discussion that since February the coke in stock had been reduced 3400 tons, and that the Gas Department was now selling all that was made daily. It was decided to keep sufficient coke for the water-gas plant, and that in the sale of the surplus preference should be given to workshops, bakeries, and the poor over such places as theatres, picture palaces, schools, and clubs. Supplies to all outside contractors were stopped a month ago.

At Rochdale, the Gas Committee are selling to the public at 4d. per 56 lbs. what coke they have for disposal; and as evidence of the great demand there is for the fuel, it may be mentioned that for the three days ended last Friday close upon 7000 people had been served in this way. Hitherto contractors have been supplied with larger quantities at 1s. 3d. per cwt.; but now the Committee have decided to restrict the sale as far as possible to those in the district requiring coke for domestic use.

The Chairman of the Gas Committee of the Southport Corporation (Mr. E. Trounson) stated last Tuesday that since a fortnight before the coal strike large demands had been made upon the gas-works for coke; and for a time every effort was used to supply poor people. They had been able to do so until the previous Saturday. Now, however, the time had come when it could no longer be supplied, because it was all required for the works. As soon as possible, however, the Committee would resume the sale of coke in small quantities to the poorer people, who had already purchased no less than 1600 tons.

CO-PARTNERSHIP CRITICIZED AND SUPPORTED.

Some correspondence has been going on in the "Westminster Gazette" on the subject of co-partnership. It was commenced by Mr. C. H. C. Osborne, who characterized it as a "dodge." In support of this expression, he asked readers of our evening contemporary to bear in mind the following points:

1.—That co-partnership may be—and generally is, where it originates, not from the initiative of the workers, but from the strategy of the masters—merely a dodge, whereby the latter obtain the maximum of security against strikes for the minimum of sacrifice. Can it, for example, be seriously contended that an equitable distribution has been effected, where, as in the case of the South Metropolitan gas-works, the 5459 employees receive 4·82 per cent. of the profits, the remaining 95·18 per cent. being the meagre pittance of the masters?

2.—That in most cases the men have not full freedom to buy and sell their shares.

3.—That where the men have power to elect representatives to the Board of Directors, the number of these representatives is determined by the aggregate sum held in shares by the men; so that, being in a minority (in the South Metropolitan Gas-Works, three in a Board of nine Directors), they are unable to influence the conditions of the industry.

4.—Finally, that profit-sharing is not co-partnership, since it does not involve any share in the responsibilities of the management.

Mr. Osborne submitted that in such cases, "while the freedom and power of capital are unrestricted, the men are bound down the tighter, and the masters are secured against the fear of a strike."

The writer was answered by a correspondent whose letter bore the initials "A. H. B." He said the fallacy underlying all such reasoning as that brought forward in Mr. Osborne's first point was that there is any distinction between the profitable result of labour and capital. Labour in its most elemental form produces the means of extending the operations of labour; and this, for convenience, is called capital. The production of gas would be impossible except by the use of this stored labour of past workers; and he submitted that to deny it its fair share of the results was as great a blow as could be struck at the share of the labourer in the profits of industry. The question as to whether 4·82 and 95·18 per cent. was an equitable distribution between labour and capital did not seem to him to be fairly stated, because it left out of account what the labourers of to-day receive, first of all the partners in the enterprise, in the way of wages. "It is curious," he said, "that what he [Mr. Osborne] states as the percentage share of the labourers of to-day on the capital which the profit-sharing arrangement has enabled them to acquire in the South Metropolitan Gas Company should so nearly correspond with the actual yield per cent. on the stock if bought in the market by any outsider to-day—viz., £4 16s. per cent." "A. H. B." submitted that Mr. Osborne's third and fourth questions answered each other. The one allowed that the men shared in the management; while the other implied that with this share in the management and its responsibilities profit-sharing became co-partnership. In conclusion, the writer thought it fairer to say that the industry is made secure against quarrels among the partners, rather than that "the masters are secured against the fear of a strike."

In a letter which appeared last Tuesday, Mr. Charles Carpenter replied to Mr. Osborne, whose letter, he said, was misleading. He therefore presented the true facts. After giving a brief history of the South Metropolitan Gas Company, and pointing out that the capital requirements for many years past have been raised at a much lower rate than the 10 per cent. fixed by Parliament when gas supply was a speculative business, he offered the following observations:

1.—The amount paid in dividend last year was at the rate of £7 13s. 3d. upon every £100 actually invested in the Company by the "capitalist"—*i.e.*, in the greatest number of instances, the thrifty. The co-partnership bonus for the same year was at the rate of £8 5s. upon every £100 paid as wages to the staff and workmen.

2.—The workmen have full freedom to buy shares and to sell them if they wish; but we do all we can by persuasion to induce them to keep and increase their holdings.

3.—It is certainly not correct to say that three Employee-Directors

upon a Board of nine are unable to influence the conditions of industry. Influence depends not upon numbers but upon personality.

4.—Profit-sharing may not be co-partnership; but it is the final step towards it. Preparation and experience are certainly necessary before the workmen can take up their share in the management. Co-partnership will fit them for their part in it; and fourteen years' experience of Employee-Directors has shown me that workmen will rise to their position upon company boards as they have in other directions, from the House of Commons downwards.

SOCIETÀ ITALIANA PER IL GAS.

Effects of the Coal Strike.

The annual report of this Italian Gas Company, which was presented to the shareholders at Turin on the 12th ult., generally shows a progressive tendency, in keeping with that of the gas industry as a whole. There are, however, one or two points of a somewhat unusual character. One of these is a temporary and slight falling off in the gas consumption at Tortona, due to the initiation of electrical competition; but we may add that we fully expect that history in this respect will repeat itself in this Italian town as it has elsewhere. A balancing feature to this is that last year saw a start made (on April 1) with a new gas supply at Venaria Reale. The figures of gas sold are as follows:

Gas Sold—Cubic Metres.

	1910.		1911.
Turin	21,597,891	..	23,779,096
Bergamo	1,790,645	..	1,843,635
Tortona	473,677	..	460,973
Girgenti	405,587	..	472,656
Venaria Reale	..	..	38,593
Total	24,267,800	..	26,594,953

This shows an increase on the year of 2,327,153 cubic metres of gas sold, or equivalent to nearly 10 per cent.

A further point to be noted is the position of affairs at Bergamo, where the present contract with the town expires in 1914, and where also the present increasing demands for gas will necessitate fresh outlay of capital on mains and other plant, directly it is seen that the gas concession will be renewed. As it is, a new condenser has already been erected.

Another item giving rise to discussion is a fiscal question relating to the taxation—rightly or wrongly—of street mains and certain machinery. These are considered by the *Amministrazione Fiscale*—erroneously, the Company contends—as being industrial works (*fabbricati industriali*), and liable under the law to taxation. Such an interpretation would cause a serious increase in the taxes paid; and, following the example of other companies, an appeal is being made to the proper authority, and it is hoped a favourable result will be the outcome of it.

The coal strike at home naturally finds its serious echo abroad. The report refers to "the repeated partial strikes and later the threat of a general strike of all the miners in the United Kingdom," and the prejudicial effect on prices. There has been an exceptional rise in freightage rates—from a normal 5s. or 6s. from England to Mediterranean ports up to 12s. and 13s., and even this may not be the limit. The price of coal has also had an upward tendency. It was 22 lire per ton in the second quarter of 1910, but 31 lire in the month of December last. This, and increases in labour charges, have compelled the Company to raise the price of gas by 2 centimes as from Jan. 1. The Company are not alone in this, as the Consumers' Company of Turin have had to make a like increase. The report expresses the hope (assuredly shared by all) that the present crisis will soon be past, and that normal conditions of the market will quickly be restored. In the meantime, everything possible will be done to secure a good yield of gas from the retorts and to effect economies wherever possible.

The successful exhibition at Turin is referred to; and as an outcome of it, the Municipality has authorized the carrying out of high-pressure gas illumination on a considerable scale. This clearly shows, says the report, "that also in this field gas can worthily compete with other systems of public lighting." The Keith-Blackman Company, of London, will be charged with carrying out the work, consisting of 500 and 1500 candle power lamps in certain streets.

At the Borgo Dora Gas-Works (Turin) four direct-fired furnaces have been converted to the regenerative system, and a twin Beale exhauster, to deal with 60,000 cubic metres per 24 hours, has been put in. Improved bye-product and ammonia plant has also been installed with good results.

The two allied Companies of the "Società Industria del Gas" and the "Società Ferrarese" have also had satisfactory increases in their gas sold; the figures being:

Gas Sold—Cubic Metres.

	1910.		1911.
Società Industria	10,068,857	..	10,237,276
,, Ferrarese	1,574,850	..	1,689,868

In conclusion, thanks are properly given to the intelligent and willing co-operation of the staff in achieving the good results obtained.

First Annual Dinner of the Treasurer's Staff of the Edinburgh and Leith Gas Commissioners.—This dinner was held at the Cathedral Hotel, Edinburgh, last Friday; some fifty members being present. The chair was occupied by the Treasurer (Mr. A. Canning Williams), who was supported by the Convener of the Finance and Law Committee (Bailie Lindsay) and the Convener of the Works Committee (Bailie Inches). A varied programme of vocal and instrumental music was gone through, and the proceedings were much enjoyed. When replying to the toast of his health, the Chairman referred to the forward policy recently inaugurated by the Commissioners, and urged each member of the staff, in his own interests as well as in those of the undertaking, to become "a missionary preaching the gospel of gas."

DONCASTER CORPORATION WATER UNDERTAKING.

Projected Extension of Mains.

At the Guildhall, Doncaster, last Thursday, Mr. H. R. Hooper, M.Inst.C.E., one of the Inspectors of the Local Government Board, held an inquiry with reference to an application by the Corporation for authority to borrow £8000 for additional water-mains.

The Town Clerk (Mr. R. A. H. Tovey) stated that the water area last year was 74,416 acres, and the population supplied was 55,800. He suggested sixty years for the repayment of the loan. The Inspector pointed out that if such a period were granted, the Corporation would pay more in interest than the actual amount they proposed to borrow; as at 3½ per cent. the interest would double itself in twenty years. The Town Clerk said at present the ratepayers were bearing a deficit upon the water undertaking for the benefit of the outside districts, which would have the greatest difficulty in supplying themselves with water at anything like the cost at which the Corporation served them. The first powers for the water undertaking were obtained under an Act of 1873, when the Thrybergh reservoir was constructed. In 1896, the Corporation became partners with the Sheffield and Rotherham Corporations in the Langsett reservoir scheme, and were entitled to receive from Langsett a million gallons of water per day. They were at present in negotiation with the Sheffield Corporation to be supplied with an additional 200,000 gallons per day from January next, rising to a maximum of 500,000 gallons per day at the end of three years. Under the Corporation Act of 1904, they then obtained powers to borrow £45,000, of which £11,000 was for a trunk main for Thrybergh to the service reservoir at Warmsworth, £11,000 for the extension of the latter reservoir, £8000 for general mains extension, and £15,000 for the purchase of minerals under the bank of the Thrybergh reservoir. There had been an increased expenditure on the main to Warmsworth, which actually cost £14,958; and instead of extending the Warmsworth reservoir, the Corporation had put down a rider main to the higher parts of the town. They had also been laying a considerable number of mains owing to developments in the district; and up to the end of March they would have spent £12,000, all of which had been paid out of revenue. The Accountant (Mr. Hanson) stated that the total amount of capital sanctioned for the water undertaking was £374,287; and the total expenditure had been £361,065. After hearing further evidence, the inquiry closed; there being no opposition.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

With the agreement to take a ballot of the miners on strike, the belief is that the colliers will soon be at work again, when it may be said that the anxieties of gas managers and engineers may be expected to pass away. The past month has been a very trying one indeed; and while a large number of the gas undertakings have been able to remain unaffected, in many cases very heavy prices had to be paid for coal. In this connection, it falls to be noted that Mr. Samuel Milne, the Gas Manager to the Aberdeen Corporation, remarked, at the annual visit to the gas-works by the Corporation, that the result of the coal strike would mean an increase in the price of coal, which would come upon the gas consumers generally.

Reports from all over Scotland go to show that the past week has been a very anxious one generally. The Glasgow Corporation have again been in the market for coal; but the gas-works' supply is more than enough for all requirements now. At the meeting of the Gas Committee of the Dundee Town Council held on Tuesday, it was reported that the supply of coal at the gas-works was sufficient to keep them going until May. In Dunfermline, only half of the street lamps are being lighted. A supply of coal, it was reported, had been obtained "at a high price," which will enable matters to be dealt with on a restricted scale for a week or two. The Kirkcaldy Town Council are now exercising every possible care over the gas supply; and during the week a reduction of 500 has been made in the number of street lamps nightly in use. The Forfar gas authorities have issued a stern warning to the effect that the inhabitants should consider the advisability of economizing the use of gas for lighting and heating, rather than wait until such time as the stock of coal is dangerously reduced. It is also recommended that all shopkeepers close their premises at as early an hour as possible. The report from Bo'ness is to the effect that the Gas Company have had carted to their works from the Kinneil Colliery many tons of cannel coal, which has relieved the feeling of apprehension locally as to the gas supply. Broughty Ferry seems to be in a pitiable plight. The stock of coal is nearing exhaustion. The street lamps are only lit at distant intervals, and shopkeepers have been enjoined to close their premises rather than light up.

A meeting of the Gas Committee of the Aberdeen Town Council was held on Wednesday—Mr. Sangster, the Convener, presiding. There was under consideration the necessary arrangements to be made in connection with the gas cookery demonstration which will commence on April 29. It was remitted to a Sub-Committee to make the arrangements. Lectures are to be given at the exhibition on gas cookery by Miss Ferguson, of the Aberdeen Domestic School of Science.

At a special meeting of the Upper District Committee of the Renfrewshire County Council held on Wednesday in the Merchants' House, Glasgow, there was submitted a requisition to alter and enlarge the existing boundaries of the Eastwood Special Lighting District, by the inclusion of an area lying to the east. The proposed extension includes the estate of Braidbar and the adjoining ground stretching towards Merrylee. The requisition was approved.

On Monday there came before Lord Skerrington, in the Court of Session, a note of suspension and interdict for Sir Charles Elphinstone Adam, Bart., of Blairadam, Kinross, and Fife, against the Town Council of Lochgelly. The complainer sought to interdict the respondents from making a bore in land on the farm of Lochonnie on the estate of Blairadam, which he contends is an infringement of his rights, and

will interfere with the minerals. The respondents say that the operations are solely for the purpose of providing a supplementary water supply, in which connection the complainer now asks for a heavy annual payment for the water drawn from their own land, which they acquired from him at a price of nearly £150 per acre. His Lordship granted interim interdict, and passed the note for the trial of the action in the ordinary course.

The District Committee of the Banffshire County Council on Thursday approved of a report by Mr. J. Barron, of Aberdeen, regarding the water supply of Findochty. It was unanimously agreed to go on with the scheme, which involves an expenditure of £2112, and the provision of a reservoir of 60,000 gallons capacity.

In the course of a lecture on "Power Producers," delivered under the auspices of the Scottish Section of the Institute of Brewers in Edinburgh on Thursday, Professor Stanfield, in the course of his address, described the use of producer gas for power purposes; and the illustrations were given by means of lantern slides.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 30.

Sulphate of Ammonia.

During the past week, the volume of business has been somewhat restricted, owing to the increasing scarcity of supplies for early shipment; but all lots coming into the market have found ready buyers at steadily hardening prices. At the close, the nearest values are: £14 16s. 3d. to £14 17s. 6d. per ton f.o.b. Hull, £14 17s. 6d. to £14 18s. 9d. per ton f.o.b. Liverpool, and £15 to £15 1s. 3d. per ton f.o.b. Leith. There continues to be a fair demand in the forward position, and it is reported that £14 7s. 6d. per ton f.o.b. at the principal ports has been repeatedly paid for equal monthly quantities July-December and October-March. Producers are now asking £14 10s. per ton over these periods; but it has not been recorded that they have obtained the higher figure.

Nitrate of Soda.

The market for this article continues very steady, and holders refuse to accept less than 11s. and 11s. 1½d. per cwt. for ordinary and refined qualities respectively on spot.

LONDON, *April* 1.

Tar Products.

The markets for tar products remain very firm. There has been a fair amount of inquiry for pitch for both prompt and forward delivery; and the price has advanced further during the week. Benzols are not very active, though the price remains steady. Heavy and solvent naphtha is in good demand. It is very difficult to do business in crude carbolic acid; consumers being very unwilling to pay the prices asked at the moment. Creosote remains firm; and there is a very good inquiry for delivery over the next five or six months.

The average values during the week were: Tar, 26s. 3d. to 30s. 3d. *ex* works. Pitch, London, 49s. 6d. to 50s. 6d.; east coast, 49s. to 50s.; west coast, Clyde 48s. to 48s. 6d., Manchester 47s. 6d. to 48s. 6d., Liverpool 48s. 6d. to 49s. 6d. Benzol, 90 per cent., naked, London, 11d.; North, 10½d.; 50-90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10d. to 10½d.; North, 9½d. to 10d. Crude naphtha, in bulk, London, 4½d. to 5d.; North, 3⅝d. to 4½d. Solvent naphtha, naked, London, 1s. to 1s. 0½d. f.o.b.; North, 10⅜d. to 11d. f.o.b. Heavy naphtha, naked, London, 11d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 2⅝d. to 3⅛d.; North, 2½d. to 2⅝d., salty; 2⅝d. to 2¾d., liquid. Heavy oils, in bulk, 3⅛d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 8d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1⅛d. to 1⅜d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has been a good demand for this article during the past week, especially for prompt delivery; and this has been the means of increasing values. Beckton is quoted at £14 5s.; outside London makes are £13 17s. 6d.; Hull, £14 12s. 6d.; Liverpool, £14 15s.; Leith, £14 16s. 3d. to £14 17s. 6d.; Middlesbrough, £14 12s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is now more hope of a settlement, so that there is more disposition to deal in coal for delivery after the termination of the strike. There are still some small lots being sold at very high prices—for instance, £2 to £2 5s. per ton for good Durham bunkers. But they are for special purposes—to get steamers away, for example. With the better hope of resumption of work, there is now more inclination to sell; but the margin is wide between the prices of buyers and sellers. As far as can be judged, best steam coals are now being quoted for after-strike delivery at about 17s. per ton f.o.b., and as high as 12s. per ton for smalls. In Durham coals, there have been quotations of about 15s. 6d. per ton f.o.b. for best gas coal, though for delivery in May 14s. 6d. per ton f.o.b. is believed to have been accepted. Prices are only problematic; and it is possible that a week or so will elapse before any really reliable values can be given. In regard to gas coke, there is a fair output, but large sales have been made in small quantities, such as ½ cwt., direct from gas-works. At Stockton and Middlesbrough, hundreds of bags of gas coke are thus sold daily, and at low prices. In one or two towns, the price is that which ruled before the strike.

Scotch Coal Trade.

Business throughout the coal trade in Scotland is practically non-existent; there being no market to speak of. A few odd lots, and stock from "bing," have changed hands at grossly inflated prices. For instance, on Friday bunker coal was delivered f.o.b. Glasgow at 35s. per ton, and round dross at 30s. per ton f.o.b. With the return of the miners to the pits, an improvement is looked for shortly.

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27

Antwerp Water-Works Company, Limited.

Moving the adoption of the report and accounts at the annual meeting of the Company, Mr. Easton Devonshire remarked upon the splendid year's working, which he referred to as an absolute record. This was principally due to the extremely hot weather and the drought. The increase of income was upwards of £11,000—£96,083, compared with £84,845; while the increase of expenditure was only £1600, and of this at least £1100 was due to the extra coal and sulphate of alumina used in purification, which was necessitated by the very largely increased amount of pumping, and the rather inferior quality of the raw water during the summer on account of the heat. Analyzing the increase of revenue, he found the State Railways paid £3160 more than in the previous year; the meter supply and trade consumers, £2800 more; the town, £600 more; and shipping, nearly £600 more. Dr. Ad. Kemna also reported that the number of new contracts was also a record. Mr. George Evans seconded the motion, which was unanimously carried. In addition to the declaration of a dividend at the rate of 13 per cent. for the year (making 12 per cent.), the shareholders passed a resolution making substantial appropriations for sinking fund for the debenture and share capital; while £10,254 was transferred to the special reserve, and £4550 remained to be carried forward. The Chairman also made an interesting statement regarding projected extension works.

Amsterdam Water Supply.

The American Consul at Amsterdam, describing the water-works of the city, says the water comes from 117 artesian wells, situated in the sand-dune district about twelve miles west of Amsterdam and about a mile from the sea. Some of these wells are 120 feet deep, and they are distributed over a territory about seven miles long and three miles wide. The water from the wells flows into a series of canals, whence it is pumped into a great reservoir. To place the supply beyond all reasonable possibility of shortage, the city now proposes to drill 60 additional wells, and increase the pumping stations and other works. Plants and fish exist in the great reservoir, and the water taken therefrom is far from pure. From the reservoir the water is conducted through a 48-inch pipe, and is pumped to the first filtering system, where, exposed to the air, most of the iron in the water is chemically extracted from it. Then the water sinks through a layer of gravel of varying fineness, to which most of the remaining iron adheres. The water is so treated in nine different filters, each with a superficial area of over 100 square yards. It then goes to a finer filter, which contains a layer of dune-sand a yard thick, under which is a layer of pebbles resting on an asphalt bottom. This filter has a superficial area of about 24,000 square yards. From here the water is pumped through pipes into the pure-water reservoir about three miles nearer Amsterdam, and thence into the city as required. The 20-inch to 24-inch pipes used for the past fifty years to conduct the water to Amsterdam are now being replaced by 30-inch pipes.

New Inverted Incandescent Gas-Lamp Company, Limited.

In moving the adoption of the report at the tenth ordinary general meeting of this Company, held last Wednesday, the Chairman (Mr. G. H. Cartland) said he thought the Directors could congratulate the shareholders on the satisfactory position occupied by the Company. During the past year, they had had a larger turnover than in any similar period in the history of the undertaking; and in the last three years they had gone on steadily and considerably increasing it. Their trading profits for 1911 were £11,667, as against £10,868 in 1910. The former figure was a record. The net profit was £10,205, against £9070; so that they had available for distribution, after including the carry-forward, a sum of £11,584. They proposed to deal with it by declaring a dividend of 6¼ per cent. (he thought this was the fifth year in succession that they had done it), absorbing £6765; by writing-off £1537 from patents, making a sum of £20,037 altogether written-off this item; by writing-off £922 from goodwill; by placing £1000 to the reserve, making it £6000; and by carrying £1357 forward. He thought the shareholders would consider this to be a very satisfactory result of the year's trading. If they looked at the balance-sheet, and compared it with those of previous years, they would see that on every point the Company's position was wonderfully improved; and he did not see why they should not go on extending their business in the future. Mr. H. Woodall seconded the motion. The report was adopted, and a dividend at the rate of 6¼ per cent. (free of income-tax) was declared.

Manchester Gas Borrowing Powers.—The Gas Committee of the Manchester Corporation have under consideration the question of applying to the Local Government Board for sanction to borrow £200,000 for gas purposes. Of this sum, £140,000 is required for meters, stoves, and gas-fires. The annual charge will be £20,858. It is expected that the increased revenue derived from an extended use of gas fires and stoves will meet this.

Gas and Meter Testing in the City of London.—According to the report of Professor Vivian B. Lewes, the Gas Examiner to the Corporation of London, the gas supply of the City last year was of a thoroughly satisfactory character, and in no case had the minimum illuminating power fallen below the parliamentary standard. The quantity of sulphur in the gas was kept within satisfactory limits; the average from all the stations having been less than 40 grains per 100 cubic feet. The Inspector of Gas-Meters reports that 97,742 meters were tested last year; the fees amounting to £2825. Compared with 1910, these figures show an increase of 8·4 per cent. in the number of meters tested, and 7·1 per cent. in the fees; while compared with the average for the last ten years, the increases are 34·6 and 25 per cent. Slot and prepayment meters represented 54 per cent. of the total. Of the entire number of meters submitted for testing, 9457 were rejected; 2588 being fast and 2920 slow in registration, 1826 failing to register, 1826 passing part of the gas unregistered, 1940 leaking, and 986 showing other faults.

1912
GAS PROPAGANDA.

LITERATURE.

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Gas-Meter Testing in Middlesex.—During the past financial year, a profit of upwards of £1000 was derived from the Middlesex County Council's gas-meter testing-station at Edmonton. Since the station was opened in 1900, a sum of £27,850 has been received in fees.

Water-Gas Plant for the Newcastle Gas-Works.—With the view of being less dependent upon coal in the future, the Directors of the Newcastle-upon-Tyne and Gateshead Gas Company have decided on installing water-gas plant equal to the production of 1½ million cubic feet per day.

Holyhead Water Supply.—At the half-yearly general meeting of the Holyhead Water Company last Tuesday, Mr. J. H. Burton (the Chairman) reported that Lady Verney had agreed to sell her rights in respect of Lake Trafwll, and also sites for the pumping-stations. Her ladyship had been extremely kind and generous in the matter, and, as a result, the Company would be the possessors of what would ultimately prove to be very valuable property. Notwithstanding all that had been said to the contrary, the water was of excellent quality. Though it was surface water, there was absolutely no pollution. Holyhead was now assured, so far as water was concerned, of an adequate supply for a considerable time to come.

Pudsey and Calverley Water Supply.—An agreement has been arrived at between the Bradford Corporation and the Pudsey Corporation and the Calverley Urban District Council relative to the renewed contract for water to be supplied by Bradford to the districts named. Twenty years ago, agreements were entered into by Pudsey, Farsley, and Calverley, under which Bradford was to supply them with water at 9d. per 1000 gallons. The contracts expire in 1913. For some years, the three outside authorities have been endeavouring to get better terms before renewing the contracts, but hitherto without success. All along the Bradford Corporation offered what are known as the "Liversedge" terms, in virtue of which they would have the right to supply water to the localities concerned in perpetuity at the same price as is charged to Bradford users—the Corporation owning the mains and collecting the rents. These terms were refused; but for a long time Bradford would not give way. Some time ago, the city authority offered a supply at 8¾d. per 1000 gallons on condition that the outside authorities would agree to a sixty years' lease. Strong objection was still offered, and Farsley dropped the negotiations and took steps for getting their own supply locally from boreholes. At a conference last week between representatives of Bradford, Pudsey, and Calverley, Bradford offered the latter a supply at 8¾d. per 1000 gallons on a sixty years' lease; provision being made that in the event of the charges being reduced or increased to large consumers in the city, the price shall be modified to the two authorities in proportion. These terms have been accepted; and details of the new arrangements will be placed before the City Council to-day. In the case of Pudsey, the new arrangement will mean a saving of about £300 a year, equal to a rate of 1½d. in the pound. The Pudsey authority make a profit of about £1500 a year by their distribution of the water which they receive from Bradford in bulk.

Municipal Coal Supply Inquiry at Bradford.—At last Tuesday's proceedings of the Finance Sub-Committee of the Bradford Corporation appointed to inquire into the feasibility of establishing a municipal coal supply for the city, some interesting figures were brought forward relating to the price of coal now and thirty years ago. It was stated that in 1880 best Haigh Moor coal was delivered in Bradford at 14s. 2d. a ton; the same coal to-day costs 21s. 9d. a ton or more. In the same period, it was stated incidentally, the increase in the miners' wages amounted to 10d. a ton. It was urged, as formerly, that as the Municipality could buy in much larger quantities than a private dealer, the wholesale price would be relatively less. After a long discussion, it was arranged for experts to be called to give evidence on the subject.

Proposed High-Pressure Gas Lighting for Leeds Market.—A new scheme for the lighting of the Leeds Market Square was presented to the Corporation Markets Committee on Monday of last week by the Chairman (Mr. Hodgson). At present the covered market is lighted by 120 electric arc lamps, which are regarded as obsolete. Mr. Hodgson has investigated the question of the cost of these lamps during the past six years; and he shows the average to have been £674 per annum. He has inquired into an alternative scheme of lighting by high-pressure gas-lamps, and states that 79 such lamps, of 1000-candle power, fixed in the centre of each passage-way and each cross-passage, will provide a far superior light. The capital cost of the lamps would be worked out in the first year, and a balance of £176 would still be left; while in later years a saving of £455 would be effected. Mr. Hodgson estimates that the lamps at present in use are costing £1 per hour. The Markets Committee adopted the scheme; and a Sub-Committee were appointed to consider the matter further.

Water from Colliery Workings for Oldham.—The important extension of the Oldham water supply by the use of the water rising from the disused workings of the Butterworth Hall Colliery of Messrs. Platt Bros. and Co., Limited, has been brought to a successful issue, and the Corporation have thereby obtained a valuable additional supply, amounting to 750,000 gallons per day. A pumping-station and other works have been erected at the colliery, and, by an agreement between the Company and the Council, the water is delivered into the storage reservoir there, and pumped into the surface reservoir at Piethorn. The water now available for use, collected from an area of some 1180 acres, is taken from workings entirely separate from the waters derived from the portions of the colliery at present in use, and is delivered into the storage reservoir by machinery supplied by Messrs. Platt Bros. The water has to be lifted 429 feet to the storage reservoir; and another lift of 325 feet is necessary to get it to Piethorn, through a main 4750 yards in length. Two suction wells have been provided—one for present use and the other for future extensions; and the engines installed are of the horizontal cross compound rotative type, having high and low pressure cylinders side by side. The estimated cost of the scheme is £25,000; and the works have been designed and carried out under the supervision of Mr. C. J. Batley, M.Inst.C.E., the Water Engineer to the Corporation.

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DAVIS Gas Stove Co., Ltd., LUTON.

Explosion of Petrol Air-Gas Plant.—The petrol air-gas plant in connection with Colonel Colfox's residence, "Coneygar," Bridport, exploded last Friday morning, wrecking the plant, and doing some damage to the building. The Gas Company's men were called in, as the house was full of visitors; and they completed the gas-fittings before dinner.

Alliance and Dublin Consumers' Gas Company.—The revenue of this Company for the half year ended the 31st of December was £155,279; and the expenditure, including interest on loan capital, &c., £117,767—showing a profit of £37,511, and £3545 was brought forward. A dividend on the consolidated ordinary stock at the rate of 5 per cent. per annum is proposed, and £2000 has been written off the suspense account, leaving £2523 to be carried forward.

Bombay Gas Company, Limited.—The profits of this Company for the past year amounted to £19,695, making, with £5357 brought forward, £25,052. After placing £710 to the reserve fund, the Directors recommend a dividend of 4½ per cent., less tax, making 7½ per cent. for the year, leaving £5443 to be carried forward. The Directors have resolved to discontinue the payment of the dividend free of income-tax; but they state that the increase in the rate will more than compensate shareholders for the change. The increase in the sale of gas last year as compared with 1910 amounted to 9·2 per cent.; so that, notwithstanding the average reduction of 6d. per 1000 cubic feet in the price of gas mentioned in the previous report, there was in 1911 an increase of £1766 in the rental from private consumers. Owing to the extension of the Company's business, it will be necessary to make a further issue of capital. The Directors express regret at recording the death of Mr. J. Hill Perrins, who held the position of Auditor of the Company.

Bromley Town Council and the South Suburban Gas Bill.—At the meeting of the Bromley Town Council last Tuesday, the Town Clerk (Mr. F. H. Norman) reported that the South Suburban Gas Bill was before the Committee of the House of Lords on the 14th and 15th of March, when they decided to amend clause 32, providing that for all time the consumers in the Bromley district should pay 7d. per 1000 cubic feet more than is charged in the existing South Suburban district. The amendment made provides that the excess payment of 7d. shall continue only for seven years, and that a reduction shall then be made of 1d. per annum until, at the expiration of fourteen years, the same amount is charged in the Bromley as in the South Suburban district. With regard to the portion of the Council's petition dealing with a test for calorific power, Counsel advised that this part of the case should be dropped; and therefore it was not pressed before the Committee. Alderman James explained, with regard to this matter, that they were advised that there was so little precedent for the inclusion of a calorific standard in a Private Bill, that the Committee were not likely to import it in the present case. There was a probability, however, of the Legislature considering the question on a broad basis. The report was adopted.

Water-Works for Sale.—From an announcement in our advertisement columns, it will probably have been seen that, pursuant to an order made by Mr. Justice Eve in the matter of the Mid-Essex District Water Company, Limited, Mr. William Richards (Messrs. A. & W. Richards) will on the 16th inst. offer for sale, at the Mart, Tokenhouse Yard, E.C., as a going concern, with possession on completion of purchase, the undertaking of the Company, supplying Dunmow and Felsted. The works comprise a pumping-station and reservoir at Dunmow, and pumping and other plant and a water-tower at Felsted.

Gas Supply of Aylesbury and Chesham.—A few days ago, the Chesham Electric Light and Power Company, Limited, issued a circular as follows to all their customers: "Owing to the serious dislocation arising from the coal strike, we regret to be compelled to restrict the supply of electricity, and reserve the right to increase the price per unit." The Gas Company immediately sent out one informing the consumers and all who wished to use gas that they had a plentiful supply of coal to meet all demands, and without raising the price of gas. We learn from Mr. G. Lane, who is the Engineer and Manager of the Chesham Gas Company, and also at Aylesbury, that he has a supply of coal at the gas-works at the latter place to last for six or seven weeks.

The Minimum Wage for Manchester Corporation Employees.—The question of the minimum wage to be paid to municipal employees will be again raised at the next meeting of the Manchester City Council. Mr. T. Fox, one of the Labour group, has given notice of a resolution which, if carried, will make the minimum wage of all Corporation labourers 26s. a week, whether they are employed within or outside the city. When the matter was last before the Council, and the minimum wage was raised from 25s. to 26s. a week for the Corporation employees working within the city, it was submitted, in opposition to the proposal, that the advance should apply all round—that the men engaged on the Thirlmere water-works, for example, or at Davyhulme, were better off with 25s. than their colleagues in the city with 26s., because of cheaper housing and facilities for growing garden produce on land adjoining their cottages.

Manchester Corporation Officials' Increased Salaries.—At last Wednesday's meeting of the Manchester City Council, all the recommendations of the Gas Committee as to advances in salary to officials in the Gas Department were approved. The principal increases were as follows: Mr. A. Price, the Chief Superintendent, £100: Mr. J. R. Hill, Manager of Bradford Road station, Mr. G. W. Tooley, Manager at Rochdale Road station, and Mr. F. P. Smith, Gas Accountant, £25 each; Mr. T. Williams, Cashier in the Gas Department, and Mr. F. J. Caldecott, Chief Rental Clerk, £15 each; Mr. T. Harrison, Gas Deposits Clerk, and Mr. Evans Williams, Senior Gas Chemist, £10 apiece; Mr. J. R. Brocklebank, superintendent of Street Mains, £25; and Mr. H. J. Brocklebank, Statistician, £15. In the Water Department, the salary of Mr. A. Neill, Financial Superintendent to the Water Committee, was increased by £50 per annum.

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BIRMINGHAM and LONDON.

Reduction in Price at Rossendale.—The Rossendale Union Gas Company brought into operation at the end of March the following reduced scale of charges: When the quarterly consumption is under 500,000 cubic feet, 2s. 11d. per 1000; 500,000 cubic feet and upwards, 2s. 10d.; for cooking, heating, and motive power, 2s. 6d. A discount of 2½ per cent. is allowed on these prices if the amount is paid in full during the first month after the expiration of the quarter.

Sequel to the Hampstead Lighting Scandal.—The Hampstead Borough Council recently held a private sitting to consider the claim made by Mr. Egerton Sayer, formerly the Chief Assistant Electrical Engineer, for three months' salary in lieu of notice. It may be remembered that Mr. G. H. Cottam, the Chief Electrical Engineer, was given six months' notice, and Mr. Sayer summarily discharged, on account of the expenditure of £25,000 on the alteration of street lighting from gas to electricity, which exceeded the estimates by £10,000. The claim, which it was decided not to contest, was for £97 10s.; and as Counsel's opinion had been taken on the matter, costs will figure on the bill the ratepayers are called upon to pay.

Rhyl Water Supply.—An inquiry was held at Rhyl last Wednesday, by Mr. W. P. Crossthwaite, one of the Inspectors of the Local Government Board, into an application made by the Urban District Council for power to borrow £3211 in connection with water supply. The Engineer (Mr. L. G. Hall) said the money was required chiefly for laying an additional 8-inch main to join the existing 7-inch and 5-inch mains, and new filtering-beds at Glascoed. It was stated that after floods the water from the impounding reservoir was discoloured on reaching the service reservoir at Glascoed, and carried much matter in suspension, causing the filter-beds to fill rapidly. This entailed constant sand skimming, and interfered with the regular working of the beds—allowing unfiltered water to get through into the district. The new gravel beds were designed to remove the trouble. Dr. A. Eyton Lloyd (the Medical Officer of Health) said the analysis of the water showed the quality to be first class. There was no opposition.

Consolidated Water-Works Company of Rosario, Limited.—The gross revenue of this Company for the past year was £107,946, and the working expenses were £47,314; leaving a surplus of £60,632. This, added to the amount brought forward, produced a sum of £63,689 available for distribution. Out of this, £4200 has been added to the reserve for the redemption of capital, £10,000 to the general reserve and contingency fund, and £3000 to the depreciation fund, and the debenture interest, interim dividends, and other charges have been paid; leaving £25,379. A final dividend of 5 per cent. is proposed on the ordinary shares; making 8 per cent. for the twelve months, free of income-tax, and leaving £6180 to be carried forward. The business made good progress last year; the number of services in the Company's district of supply having increased by 6·5 per cent., and the gross revenue by 10 per cent.

Water Scheme for Pershore District.—The Pershore Rural District Council have for some time been endeavouring to acquire a supply of water for Pershore and villages in the district, but have met with some disappointments. Recently they have been in negotiation with Sir Richard Martin, of Overbury Court, with the view of obtaining a supply from Overbury. At a meeting of the Pershore Rural District Council last Tuesday, a letter was read from Sir Richard stating that, in consequence of the report of an expert, he was unable to entertain the idea of supplying water from his springs. The Chairman (Mr. J. W. Dee) said Sir Richard at first received their application favourably, but later he said people had told him there was plenty of water near Pershore. He (the Chairman) hoped the prominent men who had informed Sir Richard that there was plenty of water would tell them where to obtain it. The Council had another scheme for acquiring a supply which would be sufficient for Pershore, and perhaps one or two villages; but he could not make it public. The Local Government Board wrote inquiring what was being done with regard to the water supply of Pershore and Cropthorne; and it was agreed to send a copy of Sir Richard Martin's letter.

GAS COMPANIES' STOCK AND SHARE LIST.

The course of things on the Stock Exchange last week went much more smoothly than the week before. Less anxiety was felt regarding possible international difficulties, money promised to shape an easier line, and confidence as to a speedy termination of the strike matured from day to day, until it culminated in the almost certain assurance that the new ballot of the colliers would show a decisive majority in favour of resuming work. Business generally was not at high pressure; and the settlement of a heavy account engrossed much attention, though, happily, no difficulties presented themselves. The opening was quiet and cautious, but free from nervousness; and prices remained steady. Government issues were firm, Railways were quiet and without much movement, and Americans showed decided strength. On Tuesday, there was a good share of fresh business doing; and the tone was pretty firm. Government issues did not attract; but Rails were in a hopeful frame, and prices went up. Americans "wobbled;" but the ups rather outweighed the downs. Wednesday began in a dull mood. Rails were shrinking all the morning. Then the tide turned, and they rose, but did not quite wipe out all their losses. Thursday was busy with the settlement. Fresh business ran very pleasantly, however; the tone being quite cheerful. The gilt-edged group were firm, and Consols rose ¼. Rails were buoyant and advanced their figures; and Americans closed well after some hesitation. On Friday, everything was good all round. Quite unlike the ordinary run of Fridays, it was the best day of the week. Gilt-edged were strongly supported; and a great demand for Consols sent the price up ⅜. Railways were lively, refreshed by the prospect of peace being re-established; and Americans rose. Saturday was very quiet, but the general tendency was quite steady. Consols closed at 78¼ to 78⅛—a rise of ⅛ in the week. In the Money Market, there was a good demand for the Stock Exchange and month-end purposes; but the supply was equal to it. Rates for discount began to harden, but gave way towards the close. Business in the Gas Market was quiet to a degree probably unparalleled in modern days. In all the placid somnolence of a sultry August holiday-tide, its match could scarcely be found. Very few quotations underwent change, and none of any magnitude. There were some dealings in Gaslight and Coke issues, the ordinary changing hands at 102⅜ to 103⅜—a fall of ¼. In the secured issues, the maximum realized from 84 to 85, the preference from 103 to 103½, and the debenture from 79 to 80. South Metropolitan was firm at 115¾ to 117. Nothing was done in Commercials. In the Suburban and Provincial group, not one issue was touched in London; but, on the local Exchanges, Liverpool "A" marked 222, and Newcastle 100. In the Continental companies, Imperial was done at 189½ and 190, and European at 20 5/16 to 20⅜. Among the undertakings of the remoter world, Monte Video marked 12, Primitiva from 7 11/16 to 7 13/16, ditto preference from 5 5/16 to 5 7/16, and ditto debenture 98½. Thus it will be seen that only six companies had dealings on the London Stock Exchange.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 12	5	Alliance & Dublin Ord.	79—82	..	6 1 11
874,000	Stk.	Jan. 12	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
250,000	5	Sept. 28	7½†	Bombay, Ltd.	6⅞—6¾	..	5 13 2
50,000	10	Feb. 29	15	Bourne-) 10 p.c.	28½—29½	..	5 1 8
332,000	10	"	7	mouth Gas) B 7 p.c.	16—16½	..	4 4 10
75,000	10	"	6	and Water) Pref. 6 p.c.	14—14½	..	4 2 9
880,000	Stk.	"	13	Brentford Consolidated	258—263	..	4 18 10
390,000	"	"	10	Do. New	195—200	..	5 0 0
50,000	"	"	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
206,250	"	Dec. 14	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
219,055	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,300	"	"	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	30	Mar. 28	12½	British	45—46*	..	5 8 8
130,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. Stk.	93—95	..	4 4 3
100,000	"	Feb. 15	6	Bromley, A 5 p.c.	126—131	..	4 11 7
165,700	"	"	4½	Do. B 3½ p.c.	98—101	..	4 9 1
83,278	"	"	5½	Do. C 5 p.c.	117—120	..	4 11 8
55,000	"	Dec. 29	3½	Do. 3½ p.c. Deb.	80—82	..	4 5 4
250,000	Stk.	"	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	"	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	76—80	..	5 12 6
157,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	107½—109½	..	5 0 6
560,000	"	"	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	"	Dec. 14	3	Do. 3 p.c. Deb. Stk.	75—77	..	3 17 11
800,000	Stk.	"	4	Continental Union, Ltd.	82—85	..	4 14 2
200,000	"	"	7	Do. 7 p.c. Pref.	133—135	..	5 3 8
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	"	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	20—21	..	4 15 3
16,160,600	Stk.	Feb. 15	4/14/8	Gas-) 4 p.c. Ord.	102⅜—103⅜	—¼	4 11 3
2,600,000	"	"	3½	light) 3½ p.c. max.	83½—85½	..	4 1 10
4,062,235	"	"	4	and) 4 p.c. Con. Pref.	102—104	..	3 16 11
4,631,705	"	Dec. 14	3	Coke) 3 p.c. Con. Deb.	79—81	..	3 14 1
258,740	Stk.	Mar. 14	5	Hastings & St. L. 3½ p.c.	93—95	..	5 5 3
82,500	"	"	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	17—17½	..	6 5 9
131,000	Stk.	Mar. 14	7½	Ilford A and C	152—154	..	4 17 5
65,780	"	"	6	Do. B	123—125	..	4 16 0
65,500	"	Dec. 29	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
4,940,000	Stk.	Nov. 10	9	Imperial Continental	188—191	..	4 14 3
1,235,000	Stk.	Feb. 15	3½	Do. 3½ p.c. Deb. Red.	88—90	..	3 17 9
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	220—222	..	4 10 1
718,100	"	"	7	Do. B.	159½—161½	..	4 6 8
306,083	"	Dec. 29	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	5	Dec. 14	6	Malta & Mediterranean	4⅜—5	..	6 0 0
560,000	100	Oct. 2	5	Met. of) 5 p.c. Deb.	101—103	+1	4 17 1
250,000	100	"	4½	Melbourne) 4½ p.c. Deb.	101—103	+1	4 7 5
541,920	20	Nov. 10	3½	Monte Video, Ltd.	12—12½	..	5 12 0
1,775,892	Stk.	Feb. 15	4⅜	Newc'tle&G'tesh'd Con.	99—101	..	4 6 8
529,705	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	86—88	..	3 19 7
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	Dec. 14	8	Oriental, Ltd.	137—139	..	5 15 1
60,000	5	Mar. 14	8	Ottoman, Ltd.	7—7½	..	5 6 8
31,800	53	Feb. 29	13	Portsea Island A	137—140	..	4 18 4
60,000	50	"	13	Do. B	130—133	..	4 17 9
100,000	50	"	12	Do. C	127—130	..	4 12 4
398,490	5	Oct. 12	8	Primitiva Ord.	7 5/16—7 7/16	+1/16	5 2 5
796,980	5	Dec. 29	5	Do. 5 p.c. Pref.	5 5/16—5 7/16	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	Dec. 29	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
250,000	5	Sept. 28	12	San Paulo, Ltd.	11½—11¾	..	5 2 2
115,000	10	"	6	Do. 6 p.c. Pref.	11⅞—12	..	5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	235—237	..	4 4 5
209,984	"	"	10	Do. B	234—236	..	4 4 9
523,500	"	"	10	Do. C	234—235	..	4 5 1
90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	115—117	..	4 13 5
1,895,445	"	Jan. 12	3	Do. 3 p.c. Deb.	78—80	..	3 15 0
209,320	Stk.	Feb. 29	8½	South Shields Con. Stk.	156—158	..	5 7 7
605,000	Stk.	Feb. 15	5/16/8	S'th Suburb'n Ord. 5 p.c.	121—123	..	4 14 9
60,000	"	"	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	"	Jan. 12	5	Do. 5 p.c. Deb. Stk.	119—121	..	4 2 8
502,310	Stk.	Nov. 10	5	Southampton Ord.	107—109	..	4 11 9
120,000	Stk.	Feb. 15	7⅛	Tottenham) A 5 p.c.	144—147	..	4 17 0
483,940	"	"	5⅝	and) B 3½ p.c.	114—116	..	4 17 0
149,470	"	Dec. 29	4	Edmonton) 4 p.c. Deb.	95—97	..	4 2 6
182,380	10	"	5	Tuscan, Ltd.	8⅜—8⅝	..	5 12 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Feb. 29	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	"	6⅞	Wands-) B 3½ p.c.	141—144	..	4 15 6
85,766	"	Dec. 29	3	worth) 3 p.c. Deb. Stk.	71½—73½	..	4 1 8

Prices marked * are "Ex. div." † Next dividend will be at this rate.

Kermodes, Limited, with a capital of £10,000, in £1 shares, has been formed to carry on the business of oil and gas engineers.

The Gas Committee of the Coventry Corporation have accepted the tender of Messrs. Clapham Bros., of Keighley (£11,230), for purifiers, and that of Messrs. Hawley and Sons, of Huddersfield (£728), for grids. A second locomotive is to be purchased for the use of the Foleshill works, at the estimated cost of £1000.

At the meeting of Stewarts and Lloyds, Limited, held in Glasgow last Thursday, Mr. Stewart stated that if it had not been for the miners' strike and its effect on the earnings of the Company their increased profits would have yielded a larger dividend. During the year they had registered an Australian subsidiary company on similar lines to the South African Company.

"Concerning Gas Cooking" is the title of an attractive pamphlet issued by Messrs. R. & A. Main, Limited, containing illustrations of their various styles of cookers and grillers, hot-plates, and boiling-rings, accompanied by prices and particulars. These are appropriately introduced by some remarks on the advantages of cooking by gas, and a few useful hints as to the care of a stove and economizing gas.

We learn that the Power-Gas Corporation, Limited, of Stockton-on-Tees, have lately secured contracts for Mond bye-product gas plant for Australia, Japan, Spain, for an electricity generating station, an electrolytic chemical works, and steel melting, and for extending the South Staffordshire Mond Gas Company's distributing station at Dudley Port; coke breeze gas plant for retort heating and brick burning; bye-product gas producers for cement works; and power-gas plant for South America. In addition to the foregoing, smaller plants to use anthracite, bituminous coal, coke, charcoal, and sawmill wood waste for power purposes are on order.

At the eighth annual meeting of Messrs. Willey and Co., Limited, last Tuesday, the Directors reported a successful year's working; and it was resolved to declare the usual dividend of 8 per cent. per annum on the ordinary shares.

An important appeal on water contamination will probably ensue on a decision given last Friday by the sitting Justices at Havant. An owner named Denham was summoned with respect to a foul well on his premises at Hayling Island; and upon a certificate from the County Analyst that the water was dangerously contaminated, the Magistrates made a closing order to take effect within 24 hours. The defendant's contention was that the contamination arose from the district authorities pouring sewage matter upon the adjacent land; and he gave notice of appeal against the judgment.

Presiding at the annual meeting of Messrs. C. & W. Walker, Limited, held last Thursday at the Grand Hotel, Birmingham, Mr. J. F. Wright, in moving the adoption of the report (noticed in the "JOURNAL" for the 19th ult.), said the year had been one of considerable unrest, anxiety, and depression, and the business of gas engineering had not escaped. Since he had been Chairman of the Company, he had never known business so unremunerative, nor had they ever found it more difficult to obtain contracts which showed a fair trading profit. It was therefore a source of great satisfaction that they were now able to present a balance-sheet showing a profit of £6400, which, though less than the previous year, was nevertheless sufficient to enable them to pay what had now become their regular dividend of 10 per cent. Since the turn of the year, things had somewhat improved; and he hoped that in the next report they would be able to show profits more commensurate with the large amount of business the Company were doing.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

LADY INSPECTOR, &c. Uxbridge Gas Company.
LADY VISITOR AND LECTURESS. "M." Box 935, Smith's Advertising Offices, London.
DRAUGHTSMAN. Bolton Gas and Lighting Committee. Applications by April 10.
SHOW-ROOM ATTENDANT, &c. No. 5541.
REPRESENTATIVES (COAL). No. 5545.

Appointments, &c., Wanted.

MANAGER, &c. No. 5546.
CHEMICAL PLUMBER, &c. No. 5492.
REPRESENTATIVE. No. 5543.

Agency (Continental).

No. 793, c/o T. B. Browne's Advertising Offices, London.

Financial Assistance Wanted.

P.O. Box 22, Sunderland.

Plant, &c. (Second-Hand), for Sale.

STEAM-ENGINES, EXHAUSTERS, CONDENSERS. Bury St. Edmunds Gas Company.

Plant, &c. (Second-Hand), Wanted.

KEITH WATER-MOTOR AND PRESSURE RAISER. Grey, Selkirk.
STATION METER, No. 5547.
WASHER-SCRUBBER. Stanley Gas Company.

Water Works for Disposal.

MID-ESSEX DISTRICT WATER-WORKS. By Auction, London Mart. April 16.

Stock and Share Sales.

BOGNOR GAS COMPANY. By Auction. London Mart. April 16.
BOURNEMOUTH GAS AND WATER COMPANY. Tenders by April 11.
BROADSTAIRS. By Auction. London Mart. April 16.
SOUTHEND WATER COMPANY. By Auction. London Mart. April 16.
UXBRIDGE GAS COMPANY. By Auction. London Mart. April 16.

TENDERS FOR

Benzol and Naphtha (crude). No. 5540.

General Stores (Brass and Copper Tubes, Lead Pipe, Sulphuric Acid).
WIGAN GAS DEPARTMENT. Tenders by April 16.

Mainlaying, &c.

HATHERSAGE GAS COMPANY. Tenders by April 25.

Oil for Gas Making.

STOURBRIDGE GAS DEPARTMENT. Tenders by April 16.

Pipes, &c.

WIGAN GAS DEPARTMENT. Tenders by April 16.

Tar.

DUNDEE TOWN COUNCIL (Road Board Specification). Tenders by April 15.
WIGAN GAS DEPARTMENT. Tenders by April 16.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EASTER HOLIDAYS.

In consequence of the EASTER HOLIDAYS, all Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office NOT LATER than the FIRST POST ON SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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O'NEILL'S OXIDE
For GAS PURIFICATION
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as rich as Bog Ore.
Gives no back Pressure.
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WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
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"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
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Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.
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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
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SPECIALLY prepared for Sulphate of AMMONIA Makers by

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Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

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RETORT SETTINGS, COAL TESTING PLANT, BOILER FIRING.

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THE MOST EXTENSIVE RANGE OF RECORDING INSTRUMENTS IN THE WORLD.

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Recording Pressure Gauges.
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Long Distance Recording Tachometers, &c., &c.

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SIMULTANEOUS Discharging-Charger The one Machine which Discharges and Charges at One Stroke.

See Advertisement March 26, p. II. of Centre.

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39, Victoria Street, Westminster, S.W.

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D. ANDERSON AND COMPANY, GAS LIGHTING ENGINEERS AND CONTRACTORS,

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AMMONIA Waste Liquor Disposal. Purification Plant.

Results Guaranteed. No Working Costs.

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AMMONIACAL Liquor wanted. Brotherton and Co., Ltd. Ammonia Distillers.

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PATENTS for Inventions. British, Colonial, and Foreign. Moderate and inclusive fees. Advice free. Trade Marks and Designs Registered. Our "GUIDE TO PATENTS" (1912 Edition) should be read and retained by all interested. Copy free on application to WITHERS & SPOONER, Chartered Patent Agents, 323, High Holborn, London. Estab. 28 years.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.

We guarantee promptness with efficiency for Repairs.

Joseph Taylor and Co., Central Plumbing Works, Bolton.

Telegrams: "Saturators, Bolton." Telephone 0848.

AMMONIACAL Liquor wanted. Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

Telegrams: "Chemicals."

SULPHURIC ACID — Specially prepared for Sulphate of AMMONIA and BENZOL Recovery Plants. John Nicholson & Sons, Ltd., Hunslet Chemical Works, Leeds. Tele.: "Nicholson, Leeds." Telephone: (Two lines), Nos. 2420 and 2421.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

Firth Blakeley, Sons, and Company, Limited, Church Fenton, near Leeds.

COAL TAR wanted. Brotherton and Co., Ltd., Tar Distillers.

Works: Birmingham, Glasgow, Leeds, Liverpool, Sunderland, and Wakefield.

AMMONIA. Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

PATENTS AND TRADE MARKS PUBLICATIONS: "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.

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THE Burnden Tar Company (Bolton), Ld., Hulton Chemical Works, BOLTON.

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SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.

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TO GAS AND WATER OFFICIALS.

BEFORE Purchasing your 1912 Cycle, kindly send post-card for our CATALOGUE-Cash or gradual Payments. Speciality, Slot-Meter Copper Collector. Melrose Cycle Co., Coventry.

TO Gas Engineers, &c., Experienced Gas-Works' Chemist now prepared to MAKE ANALYTICAL TESTS, or ASSIST Managers in Experiments by Day or Contract. Any distance. Terms Moderate.

Apply R. Walker, School Close, Farnley, Leeds.

CHEMICAL Plumber and Leadburner (London), with Sound Practical Knowledge of the Making and Repairing of Saturators of all kinds, Chambers, Towers, Tanks, &c. Own Tools. Any distance (can take Lead). Good References. Work Guaranteed.

Address No. 5492, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

A WELL-KNOWN Gas Manager's Son seeks Position as REPRESENTATIVE for a Good Gas Engineering Firm, any Department.—Gas Stoves, Meters, and Lamps preferred. Good Connection in the Western Counties and South Wales.

Address No. 5543, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

APPOINTMENT wanted for Gas- Works MANAGER in any suitable position. Twenty Years' Practical Experience, Honest, Industrious, thoroughly Reliable, Good Writer, some knowledge of Mechanics, Chemistry, &c. Highest References.

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WANTED, a Lady Inspector to visit Slot and Ordinary Consumers to give Information How to Use Cookers to the best advantage. Three Months' Engagement.

Applications, stating Experience, and Salary required, to the Manager, Gas-Works, Uxbridge.

LADY (experienced) to visit Gas Consumers' Houses to give Advice on Management of Gas-Cookers; also capable Lectureress, to Demonstrate at Gas Company's Show-Rooms. Write giving dates open, Experience, and Qualifications, also Salary expected, to "M," Box No. 935, Smith's Advertising Agency, 100, Fleet Street, E.C.

WANTED, for the Show-Room of a Gas Company in North Devon, a Smart Young Man. Must have knowledge of all Book-Keeping Pertaining to a Fittings Department, and able to Advise Consumers.

Apply, by letter, stating Age and Salary required, with References only, to No. 5541, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FINANCIER required to Finance genuine Company, now working. £6000 required. Article of Daily utility connected with Gas. Company have more orders than can execute, owing to shortage of capital. Someone preferred who would take active part (Director, &c.). Highest References.

Address Box 22, Post Office, Sunderland.

COUNTY BOROUGH OF BOLTON.

APPOINTMENT OF DRAUGHTSMAN.

THE Gas and Lighting Committee in- vite APPLICATIONS for the Appointment of DRAUGHTSMAN in the Office of the Gas Engineer.

Applicants must have had Experience in the Office of a Gas Engineer or Gas-Plant Contractor.

The Salary will be £150 per Annum.

Applications, endorsed "Draughtsman, Gas-Works," stating Age, Experience, and present Position, with *copies* of not more than Three Testimonials of recent date (which will *not* be returned), to be sent to the undersigned on or before the 10th of April next.

Canvassing in any form is strictly prohibited, and will be considered a Disqualification.

Samuel Parker, Town Clerk.

Town Hall, Bolton,
March 21, 1912.

COAL AND CANNEL.

WANTED, Two or Three Repre- SENTATIVES in Districts where they are well-known to the Gas-Works. Must have Experience, but not necessarily in Fuel.

Apply, by letter, to No. 5545, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ESTABLISHED English Engineering Firm, owning Largely Used Appliances for Gas-Works, with Representative Travelling Regularly on Continent, are open to consider AGENCY for Continent, on Mutual basis, for First-Class British Speciality.

Write to Box 793, T. B. Browne's Advertising Offices, 163, Queen Victoria Street, London.

WANTED, a Second-Hand Combined WASHER and SCRUBBER, to Pass 600,000 Cubic Feet of Gas per day. Either Horizontal Rotary Type with Steam-Engine complete, or Vertical Tower Type with Tank and Tippler—each case to include Bye-Pass Connections, Valves, and Filling.

Offers, with full Particulars, to be sent to the Stanley and District Gas Company, 9, Sandhill, Newcastle-on-Tyne.

KEITH WATER-MOTOR AND PRESSURE RAISER.

WANTED, a small Second-Hand Machine.

Gray, The Hermitage, Selkirk.

WANTED, a 10,000 to 12,000 cubic feet per hour capacity STATION METER (Second-Hand). Urgent.

Send full Particulars to No. 5547, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—The Bury St. Edmunds Gas Company have the following PLANT for Sale:—

Two Horizontal STEAM-ENGINES, each 7-inch bore by 11-inch Stroke, and 6¼-inch bore by 13-inch Stroke, respectively.
Three ROTARY EXHAUSTERS, with Valves and Connections. Capacity, 10,000 Cubic Feet per Hour. Pulleys and Shafting to connect same.
One Set of ANNULAR CONDENSERS, suitable for 20 Million Works.
One Set of 9-inch VERTICAL ATMOSPHERIC CONDENSERS, with Bye-Pass Valve, suitable for make of 35 Millions.

The above Plant is in good Working Order and Condition, having been displaced by larger.

Further Particulars may be obtained from

A. F. Young, Engineer and Manager.

Gas-Works,
Bury St. Edmunds.

FOR SALE:—

Two TOWER SCRUBBERS, 6 by 35 and 6 by 45.
Six ANNULAR CONDENSERS, 32 in. dia. by 18 ft.
GASHOLDERS, 2000 capacity and upwards.
A 12-inch STATION METER, drum 8 ft. diameter by 7 ft. 6 in. deep, equal new.
Two TANGYE'S High Speed ENGINES, 8 in. cyl.
One OIL STORAGE TANK, 12 ft. 6 in. diameter by 16 ft. deep, ¼ plates.
RETORT HOUSE, steel. One New Setting of Six Retorts, 21 in. by 15 in., 6 in. Pipes, &c., complete. Never used; re-erected cheap.
EXHAUSTERS AND ENGINES from 1500 to 40,000 cubic feet capacity per Hour, in Stock.
WASHERS and SCRUBBERS. LIVESEY Washers with 12 in. and 18. in. Valves and Connections.
KIRKHAM Scrubber Washer, 8 in. Valves.

FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Church Fenton, LEEDS.

DUNDEE TOWN COUNCIL.

TENDERS FOR TAR.

THE Town Council of Dundee invite TENDERS for the Supply of about 50,000 Gallons of refined COAL-GAS TAR in conformity with the Road Board Specifications.

Forms of Tender may be obtained from the Subscriber.

Tenders, endorsed "Tender for Tar," to be lodged with Wm. H. Blyth Martin, Town Clerk, City Chambers, Dundee, not later than Monday, the 15th of April next.

The Town Council do not bind themselves to accept the lowest or any Tender.

Jas. Thomson, City Engineer.

City Engineer's Office, Dundee,
March 28, 1912.